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For related information see also *Astronautics*.

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For related information see also *34 Fluid Mechanics and Heat Transfer*.

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91 LUNAR AND PLANETARY EXPLORATION 363
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

92 SOLAR PHYSICS 363
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 364
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

GENERAL

99 GENERAL N.A.

Note: N.A. means that no abstracts were assigned to this category for this issue.

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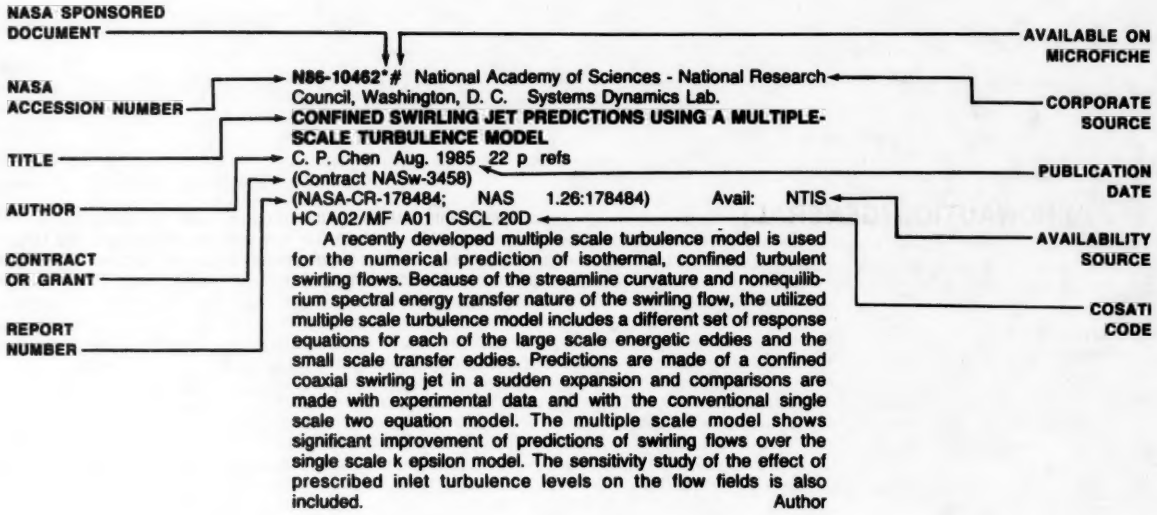
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NASA ACCESSION NUMBER
N86-10462*# National Academy of Sciences - National Research Council, Washington, D. C. Systems Dynamics Lab.
CORPORATE SOURCE
TITLE
CONFINED SWIRLING JET PREDICTIONS USING A MULTIPLE-SCALE TURBULENCE MODEL
AUTHOR
C. P. Chen Aug. 1985 22 p refs
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HC A02/MF A01 CSCL 20D
COSATI CODE
A recently developed multiple scale turbulence model is used for the numerical prediction of isothermal, confined turbulent swirling flows. Because of the streamline curvature and nonequilibrium spectral energy transfer nature of the swirling flow, the utilized multiple scale turbulence model includes a different set of response equations for each of the large scale energetic eddies and the small scale transfer eddies. Predictions are made of a confined coaxial swirling jet in a sudden expansion and comparisons are made with experimental data and with the conventional single scale two equation model. The multiple scale model shows significant improvement of predictions of swirling flows over the single scale k epsilon model. The sensitivity study of the effect of prescribed inlet turbulence levels on the flow fields is also included.
Author

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Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N86-11145* National Aeronautics and Space Administration, Washington, D. C.
AERONAUTICAL ENGINEERING: A CONTINUING BIBLIOGRAPHY WITH INDEXES
Sep. 1985 138 p
(NASA-SP-7037(191); NAS 1.21:7037(191)) Avail: NTIS HC A07 CSCL 01A

This bibliography lists 499 reports, articles and other documents introduced into the NASA scientific and technical information system in August 1985. Author

N86-11146*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DEVELOPMENT OF AN EXPLICIT MULTIGRID ALGORITHM FOR QUASI-THREE-DIMENSIONAL VISCOUS FLOWS IN TURBO-MACHINERY
Rodrick V. Chima [1985] 21 p refs Prepared for presentation at the 24th Aerospace Sci. Meeting, Reno, Nevada, 6-9 Jan. 1986; sponsored by AIAA
(NASA-TM-87128; E-2681; NAS 1.15:87128) Avail: NTIS HC A02/MF A01 CSCL 01B

A rapid quasi three-dimensional analysis was developed for blade-to-blade flows in turbomachinery. The analysis solves the unsteady Euler or thin layer Navier-Stokes equations in a body-fitted coordinate system. It accounts for the effects of rotation, radius change, and stream-surface thickness. The Baldwin-Lomax eddy-viscosity model is used for turbulent flows. The equations which are solved by a two-stage Runge-Kutta scheme made efficient by use of vectorization, a variable time-step, and a flux-based multigrid scheme, are described. A stability analysis is presented for the two-stage scheme. Results for a flat-plate model problem show the applicability of the method to axial, radial, and rotating geometries. Results for a centrifugal impeller and a radial diffuser show that the quasi three-dimensional viscous analysis can be a practical design tool. E.A.K.

N86-11147# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
AERODYNAMICS AND ACOUSTICS OF PROPELLERS
Loughton, England Feb. 1985 458 p refs In ENGLISH and FRENCH Symp. held in Toronto, 1-4 Oct. 1984
(AGARD-CP-366; ISBN-92-835-0374-0) Avail: NTIS HC A20/MF A01

A state of the art review of the aerodynamic design and testing of modern propellers, acoustic and vibration environmental problems and their solutions, and considerations in the integration of the propeller(s) and airframe is presented. Propellers have recently become a focus of attention after having been neglected for many years. The efficient use of propellers as a propulsion medium up to Mach 0.6 was realized at the expense of high noise and vibration. Since the mid-1970s there have been many developments, including the propfan, with an aerodynamic efficiency of 80% at Mach 0.8 now seriously challenges the fanjet. The advent of the supercritical airfoil is another significant development beginning to influence propeller design. For individual titles, see N86-11148 through N86-11176.

N86-11148# Lockheed-Georgia Co., Marietta. Advanced Concepts Dept.
A REVIEW OF ADVANCED TURBOPROP TRANSPORT ACTIVITIES c07
Roy H. Lange *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 16 p refs (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

The application of advanced technologies shows the potential for significant improvement in the fuel efficiency and operating costs of future transport aircraft envisioned for operation in the 1990s time period. One advanced turboprop concept originated by Hamilton Standard and NASA is known as the propfan. The concept features a highly loaded, multibladed, variable pitch propeller geared to a high pressure ratio gas turbine engine. The blades have high sweepback and advanced airfoil sections to achieve 80 percent propulsive efficiency at M = 0.80 cruise speed. Aircraft system studies have shown improvements in fuel efficiency of 15 to 20 percent for propfan advanced transport aircraft as compared to equivalent turbofan transports. Beginning with the Lockheed C-130 and Electrica turboprop aircraft, an overview of the evolution of propfan aircraft design concepts and system studies is presented. These system studies include possible civil and military transport applications and data on the performance, community and far field noise characteristics and operating costs of propfan aircraft design concepts. NASA Aircraft Energy Efficiency (ACEE) program propfan projects with industry are reviewed with respect to system studies of propfan aircraft and recommended flight development programs. Author

N86-11149# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
AERODYNAMIC METHOD USED IN FRANCE FOR ADVANCED FAST PROPELLER STUDY c07
J. M. Bousquet *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 15 p refs In FRENCH; ENGLISH summary Original language document previously announced in IAA as A85-15840 (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

Computational techniques and programs currently in use in the design analysis of aircraft propellers are surveyed and illustrated with diagrams and graphs of typical results. Methods examined include lifting line, incompressible lifting surface, three dimensional compressible, and three dimensional Euler; both classical and advanced propeller designs are considered. The Euler analysis of the experimental propeller HT1 being developed for ONERA is explored in detail, evaluating the effects of tip speed ratio, Mach number, number of blades, hub diameter, and a tapered diameter hub shroud. T.K.

N86-11150# Centre National de la Recherche Scientifique, Orsay (France).
DESIGN CONCEPT AND PERFORMANCE PREDICTION TECHNIQUE FOR POTENTIAL FLOWS AROUND ADVANCED PROPELLERS **c07**
Thoai-Sum Luu and Ranjit Collercandy *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 12 p refs (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

The design concept and performance prediction technique for potential flows around advanced propellers is presented. The design of propellers is based on the panel method, applied to the lifting surface theory in which the flow is supposed to be incompressible. A transonic performance prediction technique is developed where the resulting potential equation is solved by a finite difference approximate factorization method in a body fitted grid system. Both two and three dimensional results are presented. Author

N86-11151# Aircraft Research Association Ltd., Bedford (England).
A REVIEW OF ARA RESEARCH INTO PROPELLER AERODYNAMIC PREDICTION METHODS **c07**
A. J. Bocci and J. I. Morrison *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 19 p refs (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

An improved wake method involving a numerical solution to Goldstein's wake flow model was developed and the effects of removing Goldstein's limiting assumptions are illustrated. The representation of ARA-D airfoil data for use with the wake methods is considered, covering the wide range of geometry and flow conditions likely to be encountered on operating blades. The importance of finite blade effects is discussed and a tip relief correction is shown to improve predictions of experimental blade pressures and loadings. A method was developed to calculate the flow induced by a prescribed wake vortex sheet and some of the issues arising in calculating the flow development from the propeller disc downstream are illustrated. A three dimensional method involving solution of the compressible potential flow equation was developed, capable of predicting the blade flow in some detail for general multiblade configurations. Comparisons with experiment are shown for two blade cases. Author

N86-11152# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
MODERN PROPELLER PROFILES **c07**
A. M. Rodde, J. J. Cuny (Societe Ratier Figeac, France), and J. J. Thibert *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 12 p refs In FRENCH Original language document previously announced in IAA as A85-15841 (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

The design of a family of advanced profile composite aircraft propellers is presented, and the results of wind tunnel tests performed at the ONERA Modane S3 and CEATY S10 facilities are reported. The design specifications are outlined; the definition of profiles with relative thicknesses 4, 7, 12, and 20 percent is explained; and the test results are presented in graphs and diagrams. Significant performance improvements (relative to a NACA 16707 reference profile) are observed, including 43 and 8 percent better lift/drag ratios for cruising and ascent, respectively, 15 percent better Cz max, and equivalent critical Mach number at lower drag. The first planned application is to the Transall C160 two engine turboprop transport aircraft. T.K.

N86-11153# National Aerospace Lab., Amsterdam (Netherlands).
AERODYNAMICS OF WIDE-CHORD PROPELLERS IN NON-AXISYMMETRIC FLOW **c07**
J. B. H. M. Schulten *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 10 p refs (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

A lifting surface analysis is presented for propellers in nonaxisymmetric flow. In the analysis the Euler equations linearized about a uniform subsonic main flow are solved after separation of variables in cylindrical coordinates. This solution is obtained via an integral equation for the force distribution over the upper and lower surfaces of the blades which replaces the action of the propeller on the surrounding fluid. The boundary condition of vanishing normal velocity is applied at the actual blade surfaces, thus leading to a nonhelicoidal, unsteady lifting surface theory for propellers. Since the integral equation is solved most efficiently per circumferential Fourier component of the inflow distortion field, symmetric inflow is included naturally as the zeroth term of the Fourier series. General blade shapes can be handled as the blades may be swept both axially and azimuthally. There is no inherent limitation to the propeller tip Mach number. Apart from the calculation of the unsteady blade loading, expressions for the velocity and pressure fields are derived, in which the propeller slipstream appears explicitly as part of the complete velocity field in a form perfectly suited for wing interference calculations. Author

N86-11154# Cranfield Inst. of Tech., Bedford (England). Coll. of Aeronautics.
ON THE AERODYNAMICS OF INSTALLED PROPELLERS **c07**
Martin E. Eshelby *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 15 p refs (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

When the propeller is installed on the aircraft there will be mutual influence between the airframe and the propeller and its slipstream, two sources of that interference are examined. First, as the aircraft angle of attack changes with forward speed the angle of attack of the propeller also changes giving rise to forces and moments other than thrust and torque. Second, the high energy slipstream may pass over the tailplane and so affect the tail lift force, and in consequence a pitching moment due to power may be produced. These two effects are considered separately and means are suggested to estimate their magnitude and their effect on the handling qualities of the aircraft. Author

N86-11155# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Entwurfsaerodynamik.
A UNIFIED APPROACH FOR THE AERODYNAMICS AND ACOUSTICS OF PROPELLERS IN FORWARD MOTION **c07**
A. Das *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 28 p refs (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

The aerodynamics and the acoustics of moving bodies or surfaces follow the same basic laws of disturbance propagation and hence can be treated in a unified way. Further advancements of the propeller theories have two objectives: attaining better propulsive efficiency and producing less noise at high forward speeds. A unified aerodynamic and acoustic theory of propeller in forward motion is formulated and analyzed in detail describing the aspect of disturbance propagation from singularities in arbitrary motion, derivation of the spatial and temporal dilatations concerned with the propagation process, generalized exposition of the solution method for aerodynamics and acoustics and an extended sweep technique to determine the inducing effect of moving surfaces. In view of the flow field of a propeller being not completely irrotational the use of pressure potential proves to be more suitable in the numerical methods. The results of the analysis are illustrated by diagrams. Author

N86-11156*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THEORETICAL ANALYSIS OF LINEARIZED ACOUSTICS AND AERODYNAMICS OF ADVANCED SUPERSONIC PROPELLERS **c07**
F. Farassat *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 15 p refs (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01 CSCL 01A

The derivation of a formula for prediction of the noise of

supersonic propellers using time domain analysis is presented. This formula is a solution of the Ffowcs Williams-Hawkings equation and does not have the Doppler singularity of some other formulations. The result presented involves some surface integrals over the blade and line integrals over the leading and trailing edges. The blade geometry, motion and surface pressure are needed for noise calculation. To obtain the blade surface pressure, the observer is moved onto the blade surface and a linear singular integral equation is derived which can be solved numerically. Two examples of acoustic calculations using a computer program are currently under development. Author

N86-11157# Lockheed-California Co., Burbank.
A GENERAL THEORY OF ARBITRARY MOTION AERODYNAMICS USING AN AEROACOUSTIC APPROACH **c07**
Lyle N. Long and George A. Watts *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 12 p refs (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

The theoretical aspects of a new unsteady aerodynamics method that uses time domain aeroacoustic integral equations is described. Recent advances in theoretical aeroacoustics permit the development of general unsteady aerodynamics methods. The effects of thickness, compressibility, and arbitrary motions may be calculated for subsonic and supersonic flows. Most linearized unsteady aerodynamics methods today are limited to zero thickness effects and sinusoidal motion. The equations presented will make it possible to develop computer codes for complex three dimensional bodies, including not only complete aircraft configurations, but rotating propellers and helicopter blades as well. Panel methods for steady aerodynamics are widely used in the aircraft industry for such configurations, the present method should permit equally general configurations to be solved in unsteady motion, using a time stepping procedure. Author

N86-11158*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SUMMARY OF RECENT NASA PROPELLER RESEARCH **c07**
Daniel C. Mikkelson, Glenn A. Mitchell, and Lawrence J. Bober *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 24 p refs Previously announced as N84-32344 (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01 CSCL 01A

Advanced high speed propellers offer large performance improvements for aircraft that cruise in the Mach 0.7 to 0.8 speed regime. At these speeds, studies indicate that there is a 15 to near 40 percent block fuel savings and associated operating cost benefits for advanced turboprops compared to equivalent technology turbofan powered aircraft. Recent wind tunnel results for five eight to ten blade advanced models are compared with analytical predictions. Test results show that blade sweep was important in achieving net efficiencies near 80 percent at Mach 0.8 and reducing nearfield cruise noise about 6 dB. Lifting line and lifting surface aerodynamic analysis codes are under development and some results are compared with propeller force and probe data. Also, analytical predictions are compared with some initial laser velocimeter measurements of the flow field velocities of an eight bladed 45 swept propeller. Experimental aeroelastic results indicate that cascade effects and blade sweep strongly affect propeller aeroelastic characteristics. Comparisons of propeller nearfield noise data with linear acoustic theory indicate that the theory adequately predicts nearfield noise for subsonic tip speeds, but overpredicts the noise for supersonic tip speeds. B.W.

N86-11159# Societe Nationale Industrielle Aerospatiale, Marignane (France).
DYNAMIC BEHAVIOR OF A PROPFAN **c07**
J. M. Besson and D. Petot (ONERA, Paris) *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 15 p refs In FRENCH Original language document previously announced in IAA as A85-15842 (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

The dynamic behavior of a 1 m diameter 12 blade propfan model is investigated analytically and experimentally. Both the propfan and its individual blades are analyzed using two versions of a simplified beam model and the finite element codes ASTRONEFF and SAMCEF, considering blades of Dural alloy, CFRF, and foam filled CFRP. The modeling techniques are illustrated, and results are presented in graphs and tables. The single blade findings are compared with the results of wind tunnel tests performed at the ONERA Mondane S1 facility, and the errors of the models are found to be of the order 10 percent. The ASTRONEFF procedure is shown to be best adapted to the foam filled ribbed CFRP blade to be used in the actual propfan model. Preliminary computations of the aerodynamics and static deformation of the propfan are also presented. T.K.

N86-11160# De Havilland Aircraft Co. of Canada Ltd., Downsview (Ontario).
PERFORMANCE EVALUATION OF FULL SCALE PROPELLERS BY WIND TUNNEL TEST **c07**
D. J. Barber *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 12 p refs (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

A large propeller test facility was developed for the nine meter wind tunnel. The facility is described along with the propeller test rig features and associated drive system. Propeller performance measurement philosophy, test procedures and calibrations are discussed. In cooperation with Dowty Rotol Ltd. and Hartzell Inc., two currently available propeller designs were tested. The two 8.5 foot diameter propeller suitable for a DHC Twin Otter size of aircraft provided an evaluation of alternative airfoil applications: the ARA-D series and NACA 16 series. Results have demonstrated propeller efficiencies close to manufacturers estimates for clean well finished blades. Forward and reverse thrust testing results are discussed with respect to aircraft application. Prediction methods tend to over estimate efficiencies due to hardware features encompassing blade finish, blade root/spinner juncture, spinner openings, erosion protection and deicer equipment. Typical results illustrating the influence on propeller performance of such features is given. Author

N86-11161# Institut de Mecanique des Fluides de Marseille (France).
STUDY OF THE 3D WAKE OF AN AERIAL PROPELLER [ETUDE DU SILLAGE 3D D'UNE HELICE AERIENNE] **c07**
D. Favier and C. Maresca *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 22 p refs In FRENCH (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

An analysis of the near and far wake of a four blade aerial propeller, operated under various working parameters and following various adjustments, was carried out with hot wire anemometry. Empirical laws were synthesized which provide the axial translation velocity of the tip vortices, the rate of wake radial contraction, in such a way that the stability limit of the vortex system is established as a function of azimuth rotation and as an extended range of the working parameters active in the range from null to maximum thrust. For a given functional regime, the determination of the three dimensional induced velocity field is effective in different sections downstream of the wake and conducted in a detailed characterization of the geometry and associated vortex intensity, in the azimuth function and the axial distance to the downstream of the plane of rotation. E.A.K.

N86-11162# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
INVESTIGATIONS OF MODERN GENERAL AVIATION PROPELLERS **c07**
H. Zimmer, R. Hoffmann (Hoffmann-Propellers, Rosenheim, West Germany), and K. H. Horstmann (DFVLR, Brunswick) *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 14 p refs (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

After a period of stagnation in the years following WW2 an

accelerated movement towards propeller propulsion has taken place in recent years. Because of its inherent propulsive advantages the propeller propulsion has a considerable development potential. Initial analyses of the state of the art of propeller technology in the General Aviation field by means of flight and wind tunnel tests as well as by aerodynamic and acoustic calculations have shown possibilities for improvement, mainly in the lower and medium speed range. Improved propellers were designed and analyzed theoretically and experimentally. Newly designed supercritical airfoils with high lift to drag ratios at high lift were used. To find the optimum blade shapes associated with minimum supervelocities, also several tip shapes were analyzed. After wind tunnel tests the best of the propeller designs was selected for full scale flight test. A set of experimental propellers for the Do 228 Experimental aircraft was developed, constructed and tested. Improvements were achieved in the whole flight regime. The experience of this propeller development program was used to design a high performance high speed General Aviation propeller for M = 0.6 flight. Author

N86-11163# Dowty Rotol Ltd., Gloucester (England).
AERODYNAMIC AND STRUCTURAL ASPECTS OF PROPELLER AND DRIVE FOR A 1/5 SCALE WIND TUNNEL PROGRAMME **c07**
R. M. Bass, B. Munniksma (National Aerospace Lab., Amsterdam), and J. vanHengst (Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost) *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 18 p refs (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

The paper describes the development of a model propeller and its calibration in association with an axisymmetric nacelle in the National Aerospace Laboratory low speed tunnel in Amsterdam before testing on a complete 1/5 scale model of the Fokker in the DNW (German-Dutch wind tunnel). The calibration so obtained, allowed the required operating propeller conditions to be set up on the complete F50 model. The influence of Reynolds number on correction for scale effects, between experimental model results and full scale prediction. A previously unsuspected and unavoidable vibration originating in the reduction gear train of the drive unit gave rise to high propeller blade stresses, ultimately leading to a blade failure. In order to continue running with minimum delay, new propeller blades with high internal damping were manufactured from composite materials, and the program was successfully concluded. Author

N86-11164# De Havilland Aircraft Co. of Canada Ltd., Downsview (Ontario).
SOME CONSIDERATIONS IN PROPELLER AND AIRFRAME INTEGRATION **c07**
B. Eggleston *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 11 p refs (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

The paper review elected items of R and D limited in support of propeller driven transport aircraft. The topics include the design of new propeller airfoils, two dimensional tests of selected airfoils, and estimates are presented of the resulting benefits in propeller performance. The application of numerical optimization to the aerodynamic design of propeller is also reviewed. Some results from wind tunnel tests of airframe/propeller installations are presented showing the benefits of alternative nacelle shape and the merits of high versus low wing locations on a transport aircraft. Author

N86-11165# Avions Marcel Dassault, Saint-Cloud (France). Div. des Etudes Avancees.
PROBLEMS OF THE INTEGRATION OF PROPELLERS IN AIRFRAMES, ESPECIALLY FOR HIGH PERFORMANCE TWIN-ENGINE AIRCRAFT [LES PROBLEMES D'INTEGRATION DE HELICES A LA CELLULE D'UN AVION ET, PLUS PARTICULIEREMENT, D'UN BIMOTEUR DE FORTE PUISSANCE] **c07**
Rene Taisserie *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 10 p In FRENCH (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

This report presents studies conducted on the integration of aircraft propellers with the airframe for general aircraft, as well as for high performance twin engine propeller aircraft. The effect of engine dimensions on the aerodynamic characteristics of the aircraft in all flight situations, including low speed flight, is presented. It is shown that detailed model tests will have to be conducted before accurate results can be obtained. The objective of these studies is to examine possible configurations for future maritime reconnaissance twin engine propeller aircraft. T.M.

N86-11166# Lockheed-Georgia Co., Marietta.
WIND TUNNEL INVESTIGATION OF THE INTERACTION OF PROPELLER SLIPSTREAM WITH NACELLE/WING/FLAP COMBINATIONS **c07**
A. S. Aljabri and A. C. Hughes *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 10 p refs (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

Until recently it was sufficient to define the propeller slipstream by the average velocity induced across the propeller disk. With the advent of the highly loaded program and the accompanying concern for the effect of the slipstream and its interaction with aircraft components be known. This paper describes a series of wind tunnel tests performed to improve the understanding of this complex aerodynamic interaction. The tests were conducted using a conventional propeller operating at low subsonic speeds. Complementary theoretical and experimental studies were used to investigate the interaction effects. Results from wind tunnel tests on propeller/nacelle/wing, and propeller/nacelle/wing/flap combinations are presented here. Force, pressure, and wake survey data from the test allow the slipstream characteristics, including its distortion by the wing and flap, to be obtained. The important parameters which govern the slipstream shape and induced velocities are identified and techniques are developed for estimating slipstream drag and the torque absorbed by a wing immersed in the slipstream. An improved understanding of the effects of wind tunnel walls on propeller powered testing is also presented. Author

N86-11167*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AN ASYMPTOTIC THEORY FOR THE INTERFERENCE OF LARGE ASPECT RATIO SWEPT WINGS AND MULTIPLE PROPELLER SLIPSTREAMS **c07**
R. K. Prabhu (Old Dominion Univ.), C. H. Liu, and S. N. Tiwari (Old Dominion Univ.) *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 17 p refs (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01 CSCL 01A

This paper presents an asymptotic method for the analysis of the interference of multiple tractor propeller slipstream with large aspect ratio swept wings. It is assumed that the height of the slipstream is of the order of the wing chord and its spanwise extent is of the order of the wing span. Three different flow regions are identified by employing different stretching transformations. Asymptotic expansions are made in each of the three regions, using the chord to span ratio as the small expansion parameter. The details of the nonuniform flow in the slipstream enter into the wing sectional analysis. In the outer limit, the wing shrinks to a swept lifting line, and the slipstream reduces to a thin sheet of jet carrying the momentum gain from the propeller. The curvature of this jet sheet results in a pressure difference which is represented by a vortex sheet. The governing equations are solved by discretization. Several examples are considered for which experimental data are available. Comparison of the present results with the experimental data as well as other numerical solutions showed generally good agreement. Author

N86-11168# Carleton Univ., Ottawa (Ontario). Dept. of Mechanical and Aeronautical Engineering.

DEVELOPMENT OF MODERN TURBOPROP ENGINES c07
H. I. H. Saravanamuttoo *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 9 p refs (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

Proposals for propfan commercial aircraft operating at high cruise speeds pose requirements for advanced turboprops of high power. The history of turboprops for long range operation is briefly reviewed and the requirements for future engines are discussed. Considerable gains in the thermodynamic cycle can be realized, and the development of high performance gas generators should be a straightforward process. Transmission designs for high power engines may be extremely difficult and may result in novel engine configurations. It appears likely that a more modest goal of M = 0.7 cruise for shorter haul aircraft could be attained with much less risk while still achieving major gains. Author

N86-11169# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. for Experimental Fluid Mechanics.
AEROACOUSTIC WIND TUNNEL MEASUREMENTS ON PROPELLER NOISE c71
F.-R. Grosche and H. Stiewitt *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 9 p refs (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

Model tests were conducted in a low speed wind tunnel to determine the sound radiation of 5 propellers with different blade designs including variations of thickness ratios, blade profiles, blade planforms and blade tip configurations. The diameter of the propellers was 0.9 m, the propeller speed was kept constant. The tip Mach number was M sub l = 0.66 and the helical tip Mach number varied between 0.66 and 0.69. The main objectives were to investigate the effects of blade geometry on near field and far field noise and to locate the dominant sound sources in the propeller plane, radiating to the observer, by means of a highly directional microphone system. The results include: (1) comparisons of noise spectra of different propeller configurations; (2) near field sound pressures as function of axial distance from the propeller plane; and (3) directivity of sound radiation from the moving blades. Author

N86-11170# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.
SOME AEROACOUSTIC WIND TUNNEL MEASUREMENTS, THEORETICAL PREDICTIONS, AND FLIGHT-TEST CORRELATIONS ON SUBSONIC AIRCRAFT PROPELLERS c07
W. J. G. Trebble, J. Williams (Southampton Univ., England), and R. P. Donnelly (Dowty Rotol Ltd, Gloucester, England) *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 21 p refs (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

Aeroacoustic experiments using the full scale propeller nacelle rig in the 24 ft anechoic tunnel were first made in 1979/80 on three alternative propellers also tested in flight on the Short's 330 aircraft. The Hartzell five bladed propeller of the production aircraft has conventional NACA 64 series sections and standard tips, the Hartzell Q-tip version of this has its tips bent as lower surface end plates in the direction of rotation, and the Dowty four bladed propeller has modern ARA-D sections and standard tips (D sub p = 2.8 m). Later complementary tunnel/flight experiments also included the Dowty four bladed R.212 propeller with classical NACA 16 series sections as fitted to the B.Ae. HS 748 aircraft (D sub p = 3.7 m). Author

N86-11171# Pratt and Whitney Aircraft of Canada Ltd., Longueuil (Quebec).
AN INVESTIGATION OF IN-FLIGHT NEAR-FIELD PROPELLER NOISE GENERATION AND TRANSMISSION c71
H. Bonneau, D. F. Wilford, and L. K. Wood *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 12 p refs (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

In flight near field propeller noise measurements, made on a General Aviation turboprop aircraft, are reported for a range of propeller operating conditions, and are shown to be well defined and reproducible. Measurements have been made at 8 exterior microphones, 2 located on a wing mounted boom, and 6 embedded in, and flush with the aircraft fuselage. Interior noise levels are also presented. Measured propeller harmonic levels are compared to first principle calculations of near field noise, using a modified version of the Farassat computer program, in which the blade surface pressure is described using the known aerodynamic properties of the blade (NACA 16) airfoil sections. The first few; i.e., the dominant harmonic levels of propeller noise are shown to be well predicted, while higher harmonic levels are underpredicted. The transmission loss between exterior and interior noise levels is shown to be relatively constant for varying propeller operating conditions and at two different locations along the length of the fuselage. Interior noise levels are also shown for the aircraft in gliding flight at various forward velocities, with both engines at idle and propellers feathered. A method of interpolating these measurements is discussed, which allows the interior noise due only to the forward velocity of the aircraft, to be determined. The transmission loss for this component is also discussed. Finally, interior noise levels are presented for a series of ground static tests with engine mounts of various different stiffnessses. B.W.

N86-11172# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Entwurfsaerodynamik.
FULL-SCALE FLIGHT AND MODEL-SCALE WIND TUNNEL TESTS ON THE NEARFIELD NOISE CHARACTERISTICS OF AIRCRAFT PROPELLERS c71
H. Heller, M. Kallergis, and B. Gehlhar *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 17 p refs (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

Flight noise tests employing a single engine Cessna T 207 aircraft with an array of wing mounted microphones were conducted to investigate nearfield acoustic characteristics of a 3 blade variable pitch propeller under different operational conditions, varying helical blade tip Mach number, propeller advance ratio, and blade loading. A special technique to minimize the engine exhaust influence on the propeller signature had been developed for this purpose. Supplementary, yet much more extensive tenth scale tests were performed in the DFVLR One Meter Acoustic Tunnel again in the acoustic nearfield of propellers with 2 to 6 blades over a substantial range or operational, partially interdependent, parameters, such as helical blade tip Mach number, blade pitch angle setting, blade incidence angle, rotational plane attitude, and ambient temperature. These data could also be compared to some third scale results for geometrically identical propellers. Especially the model tests allowed an exact quantification of the effect of the various parameters on the ensuing harmonic and subharmonic propeller noise spectra. Author

N86-11173# Aeritalia S.p.A., Pomigliano D'Arco (Italy).
CABIN NOISE REDUCTION FOR A NEW DEVELOPMENT TURBOPROP COMMUTER AIRCRAFT c71
A. Carbone, A. Paonessa, L. Lecce (Ist. Progetto Velivoli, Naples), and F. Marulo (Ist. Progetto Velivoli, Naples) *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 14 p refs (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

The program followed to attain an interior noise level similar to turbofan aircraft in a new design turboprop commuter is described. The need for an early consideration, in the definition phase of the aircraft, of the acoustic requirement for configuration development is stressed, along with some peculiar characteristics of this program. After a brief presentation of features of the aircraft related to interior noise control, the analytical and experimental models developed in the course of program are discussed. Some of the results of the studies are presented, clarifying the impact that they have had on the configuration of the aircraft. The output of three structural analysis theoretical procedures is compared to

experiments. Two of these procedures, the panel stringer periodic model, and a simplified FEM analysis, are found adequate to represent experimental findings. The cylindrical shell - frame model is found not representative of test results. Sidewall treatment performance is discussed, with reference to theoretical and experimental results. The noise reductions measured in a furnished fuselage are compared to data obtained without interior treatment. Future developments and recommendations for additional work are discussed. Author

N86-11174# Lockheed-California Co., Burbank.
PROPELLER AIRCRAFT CABIN VIBRATION AND NOISE-EXCITATION, SOURCES, AND PATHS **c71**
R. E. Donham, F. J. Balena, E. Z. Bochary, and O. K. Liehr *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 14 p refs (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

The potential sources and paths by which the propeller produces structural responses resulting in vibration and noise in the cabin of a transport aircraft are discussed. New low cost, convenient experimental and analytical techniques are described for evaluating the excitations; propeller airborne pressures on the fuselage shells, slip stream induced forces on the wing and tail, and oscillatory forces on the propeller. The techniques described make use of ground determined structural signatures to relate forces with vibrations or noise, and of propeller signatures from flight which define the vibroacoustic contributions of individual propellers. Author

N86-11175# Hamilton Standard, Windsor Locks, Conn.
THE STATE OF THE ART IN PROPFAN TURBOPROP NOISE **c71**
Frederick B. Metzger *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 20 p refs (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

The evolution of propeller noise research is summarized from 1919 to the present. The early experimental and analytical work to understand and predict propeller noise is discussed. Emphasis is placed on understanding source noise. However, the major advances in cabin comfort assessment and design of airplane fuselage and cabin trim to improve passenger comfort are briefly described. Emphasis is on the recent noise research work on the propfan, a many bladed relatively small diameter unshrouded motor with swept blades that will allow future transports to cruise efficiently at speeds equal to modern turbofan transports. The most recent propfan concept, a counter rotation version with even greater efficiency potential than the propfan with a single blade row is also discussed. Author

N86-11176# Lockheed-Georgia Co., Marietta.
APPLICATION OF ACTIVE NOISE CONTROL TO MODEL PROPELLER NOISE **c71**
M. Salikuddin, H. K. Tanna, R. H. Burrin, and W. E. Carter *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 15 p refs (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

The applicability of active noise control to reduce cabin noise of turboprop aircraft is demonstrated by conducting several laboratory experiments. The principle of active noise control is to reduce the noise radiated from a primary source by superimposing a signal from a secondary source, which is made identical in amplitude but opposite in phase to the primary sound signal. A computer controlled algorithm was developed to implement this concept in a free field environment, in which, the noise from the primary source (eventually the propeller) and the noise measured at several locations on a representative surface (eventually the fuselage) were used to create the input for the secondary source. Experiments using a number of sinusoidal signals were conducted. An average noise reduction of 8 to 14 dB was achieved on the surface in the frequency range of 200 to 1000 Hz. Next the concept was applied to the propeller problem where the sound signal contains many discrete tones at harmonics of the blade passage frequency. For this purpose, a prerecorded time history of a 1/10th scale model propeller was used to drive the primary source. An average noise reduction of about 15 dB was observed at the first two blade passage frequencies, and 12 dB and 5 dB reductions were observed at the 3rd and 4th blade passage frequencies, respectively. Finally, the active noise control concept was applied to a 1/10th scale propeller, installed in an anechoic chamber with flight simulation facility. A substantial amount of noise reduction was achieved on the model fuselage surface. Author

N86-11177# Joint Publications Research Service, Arlington, Va.
USSR REPORT: TRANSPORTATION
7 Oct. 1985 106 p Transl. into ENGLISH from various Russian articles
(JPRS-UTR-85-011) Avail: NTIS HC A06

Progress in U.S.S.R. transportation is reported. Topics discussed include: civil aviation; motor vehicles and highways; rail systems; maritime and river fleets; and ports and transshipment centers. For individual titles, see N86-11178 through N86-11181.

N86-11178# Joint Publications Research Service, Arlington, Va.
DEPUTY MINISTER ON SECTOR'S TECHNICAL PROGRESS
I. Ye. Mashkivskiy *In its* USSR Rept.: Transportation (JPRS-UTR-85-011) 7 Oct. 1985 p 1-6 Transl. into ENGLISH from Grazhdanskaya Aviats. (Moscow), no. 4, Apr. 1985 p 2-3 (For primary document see N86-11177 02-01)
Avail: NTIS HC A06

Measures to accelerate the U.S.S.R.'s scientific and technical progress in the area of civil aviation are discussed. The development of more economical and efficient modifications of airplanes, helicopters, and engines to replace outdated models is described. The increased use of automated diagnostic equipment for aircraft maintenace is highlighted. B.W.

N86-11179# Joint Publications Research Service, Arlington, Va.
CHIEF OF AEROFLOT'S INTERNATIONAL ACTIVITIES **c03**
V. Samorukov *In its* USSR Rept.: Transportation (JPRS-UTR-85-011) 7 Oct. 1985 p 7-11 Transl. into ENGLISH from Grazhdanskaya Aviats. (Moscow), no. 6, Jun. 1985 p 6-7 (For primary document see N86-11177 02-01)
Avail: NTIS HC A06

Aeroflot's role in expanding the U.S.S.R.'s international civil aviation service in socialist countries is summarized. Intergovernmental agreements concerning new aviation routes and joint operation of individual international airroutes are discussed. B.W.

N86-11180# Joint Publications Research Service, Arlington, Va.
RECENT ACHIEVEMENTS, PROBLEMS IN CROPDUSTING WORK **c05**
A. Savchenko *In its* USSR Rept.: Transportation (JPRS-UTR-85-011) 7 Oct. 1985 p 12-16 Transl. into ENGLISH from Grazhdanskaya Aviats. (Moscow), no. 4, Apr. 85 p 26-27 (For primary document see N86-11177 02-01)
Avail: NTIS HC A06

The long-term program for land reclamation that was discussed and approved at the October (1984) Plenum of the CPSU Central Committee represents a major new stage in the campaign for further increases in the fertility of crop lands and for fulfillment of the food program. Many sectors of the national economy, including civil aviation, are directly involved in the realization of these goals. With the aim of carrying out the decisions of the Central Committee Plenum, measures have been worked out to expand Aeroflot's contribution to increasing the efficiency of improved lands in order to bring about a steady rise in the U.S.S.R's food stores. Aviation science is supposed to play an important role in this important statewide task. Increasing the efficiency and improving the quality of the use of aviation in agriculture are tasks that are being resolved through the creation and improvement of aircraft and agricultural equipment, the introduction of progressive methods, and efficient utilization of aircraft. An overview is presented of survey techniques used in cropdusting. B.W.

N86-11181# Joint Publications Research Service, Arlington, Va.
WORLD'S LARGEST AIRPLANE NOW BEING TESTED c05
N. Dombkovskiy *In its* USSR Rept.: Transportation (JPRS-UTR-85-011) 7 Oct. 1985 p 17-20 Transl. into ENGLISH from TRUD (Moscow), 23 May 1985 p 3 (For primary document see N86-11177 02-01)
Avail: NTIS HC A06

Unique design features of the newly developed AN-124 aircraft are described. Factors such as weight, cargo capacity, and wing configuration are discussed. Problems encountered in the construction of the AN-124 are also discussed. B.W.

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N86-11182 Maryland Univ., College Park.
A PARAMETRIC ANALYSIS OF FLOW STRUCTURE AND PERFORMANCE IN A VORTEX CONTROLLED RADIAL DIFFUSER Ph.D. Thesis
John E. Allen 1984 155 p
Avail: Univ. Microfilms Order No. DA8512169

The air flow characteristics in a vortex controlled radial diffuser have been investigated using non-orthogonal, two-component LDV measurements in the entrance region of the diffuser. The velocity components and turbulence parameters in a plane of the axisymmetric flow field were mapped for four geometric configurations, with and without suction. These detailed measurements, supported by overall performance parameters, yielded considerable insight into the interaction between the forced recirculation region and the core flow. Particularly emphasized were the influence of suction, vortex corner size and vortex corner configuration on the diffuser geometries analyzed. The non-intrusive technique employed permitted measurements to be obtained in a particularly difficult environment requiring a series of tradeoffs to maintain a flowfield which was representative of that encountered in the practical application of such a device. Dissert. Abstr.

N86-11183 Kansas Univ., Lawrence.
INLET FLOW DYNAMIC DISTORTION PREDICTION WITHOUT rms MEASUREMENTS Ph.D. Thesis
Yen-Sen Chen 1984 118 p
Avail: Univ. Microfilms Order No. DA8513816

A two-equation turbulence model, k-epsilon model, is used in the prediction of inlet flow dynamic distortion of jet aircraft based on steady state total pressure measurements only. This Turbulence model is solved at the compressor face station by using a finite difference scheme. Total pressure rms level of the inlet flow is predicted by the turbulence model. The Melick statistical method is then employed to estimate the peak dynamic distortion based on the analytically predicted total pressure rms level. A statistical method is developed for the estimation of boundary conditions for the turbulent equations. In order to solve the set of nonlinear, coupled turbulent equations, an implicit formulation is utilized such that a set of discretized finite difference equations can be arranged into tridiagonal matrix equations for efficient numerical iterations. Results of the prediction compare well with experimental measurements of subsonic, transonic and supersonic inlets under various flight conditions. The present method can be used in the preliminary inlet design phases to reduce the design costs. Dissert. Abstr.

N86-11184 Arizona Univ., Tucson.
REFINED NUMERICAL SOLUTIONS OF THE TRANSONIC FLOW PAST A WEDGE Ph.D. Thesis
Shen-Min Liang 1985 76 p
Avail: Univ. Microfilms Order No. DA8511705

An adaptive refinement procedure combining the ideas of solving a modified difference equation and of adaptive mesh refinement is introduced. The numerical solution on a fixed grid is improved by inclusion of approximated truncation error computed from local subgrid refinement. Following this procedure, a reliable scheme has been developed for refined computations of the flow past a wedge at transonic speeds. Effects of the truncation error on the pressure, wave drag, sonic line, and shock position are investigated. By comparing the pressure drag on the wedge and the wave drag due to the shocks, the existence of a supersonic-to-supersonic shock originating from the wedge shoulder is confirmed. Dissert. Abstr.

N86-11185 Maryland Univ., College Park.
STABILITY AND INTERACTION OF COHERENT STRUCTURE IN SUPERSONIC REACTIVE WAKES Ph.D. Thesis
Suresh Menon 1984 185 p
Avail: Univ. Microfilms Order No. DA8508501

A theoretical formulation and analysis is presented for a study of the stability and interaction of coherent structure in reacting free shear layer. The physical problem under investigation is a premixed hydrogen-oxygen reacting shear layer in the wake of a thin flat plate. The coherent structure is modeled as a periodic disturbance and its stability is determined by the application of linearized hydrodynamic stability theory which results in a generalized eigenvalue problem for reactive flows. Detailed stability analysis of the reactive wake for neutral, symmetrical and antisymmetrical disturbance is presented. Reactive stability criteria is shown to be quite different from classical non-reactive stability. The interaction between the mean flow, coherent structure and fine-scale turbulence is theoretically formulated using von Karman integral technique. Both time-averaging and conditional phase averaging are necessary to separate the three types of motion. The resulting integro-differential equation can then be solved subject to initial conditions with appropriate shape functions. Dissert. Abstr.

N86-11186*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EFFECT OF AILERON DEFLECTIONS ON THE AERODYNAMIC CHARACTERISTICS OF A SEMISPAN MODEL OF A SUBSONIC ENERGY-EFFICIENT TRANSPORT
Peter F. Jacobs Oct. 1985 344 p refs
(NASA-TP-2478; L-15934; NAS 1.60:2478) Avail: NTIS HC A15/MF A01 CSCL 01A

An investigation was conducted in the Langley 8 Foot Transonic Pressure Tunnel to determine the effect of aileron deflections on the aerodynamic characteristics of a subsonic energy efficient transport (EET) model. The semispan model had an aspect ratio 10 supercritical wing and was configured with a conventionally located set of ailerons (i.e., a high speed aileron located inboard and a low speed aileron located outboard). Data for the model were taken over a Mach number range from 0.30 to 0.90 and an angle of attack range from approximately -2 deg to 10 deg. The Reynolds number was 2.5 million per foot for Mach number = 0.30 and 4 million per foot for the other Mach numbers. Model force and moment data, aileron effectiveness parameters, aileron hinge moment data, otherwise pressure distributions, and spanwise load data are presented. Author

N86-11187# Cranfield Inst. of Tech., Bedford (England). Coll. of Aeronautics.
GROUND EFFECT ON A ROTOR WAKE Ph.D. Thesis - March 1985
I. Kusmarwanto Jun. 1985 116 p refs
(Coll-Aeronautics-8510) Avail: NTIS HC A06/MF A01

The effect of the ground on a rotor wake in forward flight was investigated experimentally in the working section of an 8 ft x 4 ft straight through wind tunnel. A three bladed fully articulated rotor with a solidity ratio of 0.07 and diameter of 1.06 m, powered by a hydraulilc motor, was tested at a height of 0.47 rotor diameter above a solid ground board which has a elliptical leading edge. Tests were run at various low advance ratios (less than 0.1) with

two collective pitch settings. A hot wire anemometer probe was used to measure the average value of the three components of velocity. The rotor wake and the ground vortices were visualized by smoke. Both experimental results and theoretical estimates show that the ground induced interference is an upwash and a decrease in forward velocity. Author

N86-11188*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SHOCK FITTING APPLIED TO THE PREDICTION OF HIGH-SPEED ROTOR NOISE
John W. Rutherford Oct. 1985 19 p refs
(NASA-TM-86781; Rept-85384; NAS 1.15:86781; USAAVSCOM-TR-85-A-8) Avail: NTIS HC A02/MF A01 CSCL 01A

A shock fitting method applied to the transonic small disturbance (TSD) potential equation is described. This method is then applied to a simple, two dimensional (2-D) rotating disturbance which is analogous to a shock radiating from the tip of a rotor blade in high speed hover. A comparison is made between the results of this method and the more standard shock capturing method. This comparison makes it clear that the effect of the results on the acoustic signature of the 2-D model is significant, and similar results can be expected when the method is extended to the three dimensional (3-D) case. Author

N86-11189*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
USER'S MANUAL FOR A 0.3-m TCT WALL INTERFERENCE ASSESSMENT/CORRECTION PROCEDURE: 8- BY 24-INCH AIRFOIL TEST SECTION
Clyde R. Gumbert Sep. 1985 49 p refs
(NASA-TM-87582; NAS 1.15:87582) Avail: NTIS HC A03/MF A01 CSCL 01A

A transonic Wall-Interference Assessment/Correction (WIAC) procedure has been developed and verified for the 8- by 24-inch airfoil test section of the Langley 0.3-m Transonic Cryogenic Tunnel. This report is a user's manual for the correction procedure. It includes a listing of the computer procedure file as well as input for and results from a step-by-step sample case. Author

N86-11926# Joint Publications Research Service, Arlington, Va.
TRANSITION EFFECTS OF BOUNDARY LAYER ON STATIC AND DYNAMIC STABILITY OF SLENDER CONE Abstract Only
Hongtian Lou *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-014 2 May 1985 p 78 Transl. into ENGLISH from Yuhang Xuebao (Beijing), no. 1, 31 Jan. 1985 p 88-98 Original language document announced in IAA as A85-42783 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N86-11190# Air Command and Staff Coll., Maxwell AFB, Ala.
COMING SOON TO A THEATER NEAR YOU: THE MICROWAVE LANDING SYSTEM
K. S. C. Hamilton Apr. 1985 23 p
(AD-A156468; ACSC-85-1025) Avail: NTIS HC A02/MF A01 CSCL 01/2

This informational handbook has been prepared in response to a requirement levied by the SAC Instrument Flight Course (SIFC), Castle AFB, California. The Microwave Landing System (MLS) is projected for worldwide installation and use by both civilian and military facilities. This handbook has been developed for use in conjunction with an individualized lesson plan, prepared by the SIFC faculty. The history, development, advantages, and future projections for this excellent system are explained. The handbook is not a text for engineers, but for the pilot who is interested in safety of flight, noise abatement, and increased system confidence. The author's intent in authoring this project was to provide a brief introduction to the reasons behind the transition from Instrument Landing System (ILS) to the Microwave Landing System (MLS), and the international scope of this endeavor. Through the comparison of the operational and maintenance advantages of these two systems the author hopes to capture the interest of pilots by making them aware of the tremendous technological gains embodied in the Microwave Landing System. GRA

N86-11191# Federal Aviation Administration, Atlantic City, N.J. Technical Center.
USER'S MANUAL FOR AC-20-53A PROTECTION OF AIRPLANE FUEL SYSTEMS AGAINST FUEL VAPOR IGNITION DUE TO LIGHTNING
N. Rasch Oct. 1984 72 p
(AD-A157619; DOT/FAA/CT-83/3) Avail: NTIS HC A04/MF A01 CSCL 01/2

This manual provides users of AC 20-53A, protection of aircraft fuel systems against fuel vapor ignition due to lightning, with information on the subject of fuel system lightning protection and methods of compliance of aircraft design with the Federal Aviation Regulations 23.954 and 25.954. The manual is the result of a 3-year effort requested by the FAA Technical Center of the SAE-AE4L committee which is comprised of experts in the field of lightning research and protection of aircraft and systems from the adverse effects associated with atmospheric electricity. GRA

N86-11179# Joint Publications Research Service, Arlington, Va.
CHIEF OF AEROFLOT'S INTERNATIONAL ACTIVITIES
V. Samorukov *In its* USSR Rept.: Transportation (JPRS-UTR-85-011) 7 Oct. 1985 p 7-11 Transl. into ENGLISH from Grazhdanskaya Aviats. (Moscow), no. 6, Jun. 1985 p 6-7 (For primary document see N86-11177 02-01)
Avail: NTIS HC A06

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N86-11192# IIT Research Inst., Annapolis, Md.
TRAFFIC ALERT AND COLLISION AVOIDANCE SYSTEM SIGNAL ENVIRONMENT MODEL (TCAS SEM) PROGRAMMER'S REFERENCE MANUAL Final Report, Aug. 1984 - Feb. 1985
C. Gilchrist, E. Woods, and T. Keech Jul. 1985 169 p refs Prepared for Dept. of Defense, Annapolis
(Contract F19628-80-C-0042)
(FAA-PM-85-22; ECAC-CR-85-031) Avail: NTIS HC A08/MF A01

A traffic alert and collision avoidance system signal environment model (TCAS SEM) was developed to predict the time-average TCAS I and minimum TCAS II signal rates in a user-selected air traffic deployment. The TCAS SEM is described which includes: the modeled systems, the data-storage and retrieval subsystems for engineering data, and the software structures of all component subsystems. E.A.K.

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N86-11193*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

A PERSPECTIVE ON THE STATUS OF MEASUREMENT OF ATMOSPHERIC TURBULENCE IN THE US

H. N. Murrow Sep. 1985 38 p refs Presented at the Subcomm. Meeting of 61st AGARD Struct. and Mater. Panel Meeting, Oberammergau, West Germany, 10-13 Sep. 1985

(NASA-TM-87610; NAS 1.15:87610) Avail: NTIS HC A03/MF A01 CSCL 04B

A perspective on status of measurement of atmospheric turbulence is presented. Details are given for turbulence characteristics measured in four distinct meteorological conditions. The emphasis is on identifying appropriate values of L, the integral scale value in the von Karman expression. On-going activity to measure spanwise gradients of turbulence at low altitudes is described. A resume of the NASA VGH program is given, as well as on-going utilization of flight recorder data on wide-body transports to reconstruct special turbulence encounters. Reference is made to some other activities regarding sensing, measurement, modeling, and alleviation. Author

N86-11194*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

EXPERT SYSTEMS DEVELOPMENT AND APPLICATION

Eugene L. Duke and Victoria A. Regenie Oct. 1985 8 p Presented at the IEEE Symp. on Expert Systems in Govt., McLean, Va., 23-25 Oct. 1985

(NASA-TM-86746; H-1310; NAS 1.15:86746) Avail: NTIS HC A02/MF A01 CSCL 01C

Current research in the application of expert systems to problems in the flight research environment is discussed. In what is anticipated to be a broad research area, a real time expert system flight status monitor has been identified as the initial project. This real time expert system flight status monitor is described in terms of concept, application, development, and schedule. Author

N86-11195*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

DESCRIPTION OF AN EXPERIMENTAL EXPERT SYSTEM FLIGHT STATUS MONITOR

Eugene L. Duke and Victoria A. Regenie Oct. 1985 11 p refs Presented at the 5th AIAA Computers in Aerospace Conf., Long Beach, Calif., 21-23 Oct. 1985

(NASA-TM-86791; H-1317; NAS 1.15:86791; AIAA-85-6042-CP) Avail: NTIS HC A02/MF A01 CSCL 01C

This paper describes an experimental version of an expert system flight status monitor being developed at the Dryden Flight Research Facility of the NASA Ames Research Center. This experimental expert system flight status monitor (ESSFSM) is supported by a specialized knowledge acquisition tool that provides the user with a powerful and easy-to-use documentation and rule construction tool. The EESFSM is designed to be a testbed for concepts in rules, inference mechanisms, and knowledge structures to be used in a real-time expert system flight status monitor that will monitor the health and status of the flight control system of state-of-the-art, high-performance, research aircraft. Author

N86-11196*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

COMPARISON OF CALCULATED AND MEASURED VELOCITIES NEAR THE TIP OF A MODEL ROTOR BLADE AT TRANSONIC SPEEDS

Michael E. Tauber, F. Kevin Owen (Complere, Inc.), Ronald G. Langhi (Informatics General Corp., Palo Alto, Calif.), and Grant E. Palmer Aug. 1985 81 p refs

(NASA-TM-86697; Rept-85158; NAS 1.15:86697) Avail: NTIS HC A05/MF A01 CSCL 01C

The ability of the ROT22 code to predict accurately the transonic flow field in the crucial region around and beyond the tip of a high speed rotor blade was assessed. The computations were compared with extensive laser velocimetry measurements made at zero advance ratio and tip Mach numbers of 0.85, 0.88, 0.90, and 0.95. The comparison between theory and experiment was made using 300 scans for the three orthogonal velocity components covering a volume having a height of over one blade chord, a width of nearly two chords, and a length ranging from about 1 to 1.6 chords, depending on the tip speeds. The good agreement between the calculated and measured velocities established the ability of the code to predict the off blade flow field at high tip speeds. This supplements previous comparisons where surface pressures were shown to be well predicted on two different tips at advance ratios to 0.45, especially at the critical 90 deg azimuth blade position. These results demonstrate that the ROT22 code can be used with confidence to predict the important tip region flow field including the occurrence, strength, and location of shock waves causing high drag and noise. Author

N86-11197# Air Command and Staff Coll., Maxwell AFB, Ala.

EVALUATION OF FAULT REPORTING/FAULT ISOLATION FOR F-15 AIRCRAFT

C. A. Mussari Apr. 1985 26 p

(AD-A156516; ACSC-85-1955) Avail: NTIS HC A03/MF A01 CSCL 01/3

The author set out to see if the accuracy of the FR/FI manuals is a factor in their non-use. Accuracy of the manuals was determined by analyzing actual reported inflight discrepancies. Fault code accuracy was obtained by comparing each discrepancy as written on the TAC Form 122 (Debriefing Record) with the discrepancy depicted in the FR manual. Accuracy of repair actions was obtained by tracking the repair action recommended by the fault isolation manual and comparing it with that shown on the TAC Form 122. Analysis revealed the F-15 fault reporting manual can accurately represent a random inflight malfunction 83.8% of the time, and these malfunctions can be accurately isolated in the fault isolation manual 77.7% of the time. These accuracy levels are acceptable and not a major factor in the non-use of the manuals. Observation of the debriefing and maintenance process, and interviews with aircrews and maintenance technicians, revealed a general lack of understanding and confidence in the FR/FI system. This lack of understanding and confidence, exhibited by both aircrews and maintenance personnel is the primary reason for the system's non-use. Recommended actions to show the effectiveness of using the system as designed are provided. GRA

N86-11198# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.

A COMPARISON OF THE NAVTOLAND (NAVY VERTICAL TAKEOFF AND LANDING) SH-2F HELICOPTER MODEL WITH THE REQUIREMENTS OF MIL-H-8501A AND WITH FLIGHT DATA Final Report

R. L. Nave 31 Jan. 1984 78 p

(F41-400)

(AD-A157297; NADC-84166-60) Avail: NTIS HC A05/MF A01 CSCL 01/4

This report compares the dynamic response characteristics of an SH-2F simulator model with available flight test data and with the requirements of MIL-H-8501A, Helicopter Flying and Ground Handling Qualities; General Requirements for. The Navy Vertical Takeoff and Landing (NAVTOLAND) simulator model was developed to facilitate the design of an automatic approach and landing guidance control systems for helicopters and V/STOL aircraft. The simulation was validated by comparing the model response with all available flight test data. In addition, the model was used to examine some of the requirements of MIL-H-8501A. Considerable insight was gained in the application of the specification and in understanding techniques needed to determine compliance with the requirements. The original model was developed and installed

on the NASA Ames Vertical Motion Simulator. Numerous modifications were made to the software based on test pilot evaluations. A version of this simulation model including all empirical adjustments was installed on the NAVAIRDEVCEN computer system. Further evaluation of the model was carried out using this batch version of the helicopter model. This study found that it is difficult if not impossible to satisfactorily tune a helicopter simulation based on pilot opinions without a complete flight test data base. The requirements of MIL-H-8501A need to be defined in more detail and in some cases be revised. An altitude excursion limit should be added to the current quick stop maneuver. Analysis indicates that the current 2-second pilot response delay following engine failure may be excessive. GRA

N86-11199# McDonnell Automation Co., St. Louis, Mo.
FLIGHT WORTHINESS OF FIRE RESISTANT HYDRAULIC SYSTEMS: VOLUME 1 Final Report, Jan. 1981 - Dec. 1984
J. R. Jeffery, R. B. Merrell, N. J. Pierce, M. J. Stevens, and R. E. Young Dec. 1984 307 p
(Contract F33615-80-C-2074)
(AD-A157618; AFWAL-TR-84-2085-Vol-1) Avail: NTIS HC A14/MF A01 CSCL 13/7

This volume reports a study to select a flight worthy hydraulic system in which to test the chlorotrifluoroethylene (CTFE) hydraulic fluid. Aircraft selection, hardware and concept definition, system and weight analysis, and reliability, maintainability and life cycles costs (LCC) studies are reported in volume 1. The F-15 and KC-10A were selected for comparison between the present fluid and system configuraation and CTFE fluid at 8,000 psi plus various energy conservation and water hammer control concepts. The results show the weight penalty of the nonflammable fluid (CTFE) can be overcome by use of 8,000 psi operating pressures. Performance, water hammer transients, fluid pumpability, sealing, null leakage control, and demonstration system effects were investigated during Phases 2 and 3 of this contract. GRA

N86-11200# National Center for Atmospheric Research, Boulder, Colo.
CALIBRATION OF THE NCAR (NATIONAL CENTER FOR ATMOSPHERIC RESEARCH) SABRELINER RESEARCH STATIC PRESSURE SOURCE WITH A TRAILING CONE ASSEMBLY
E. N. Brown Mar. 1985 21 p refs Sponsored in part by NSF (PB85-191005; NCAR/TN-253/EDD) Avail: NTIS HC A02/MF A01 CSCL 01B

Trailing cone results verify that pressure corrections for the NCAR Sabreliner derived from tower flyby data can be extrapolated to higher Mach numbers and higher altitudes with valid results. Residual static pressure errors are small, on the order of 0.1 to 0.3 mb, corresponding to altutide errors of 20 to 30 ft for altitudes of 15,000 to 39,000 ft and Mach numbers of 0.59 to 0.76.
Author (GRA)

N86-11180# Joint Publications Research Service, Arlington, Va.
RECENT ACHIEVEMENTS, PROBLEMS IN CROPDUSTING WORK
A. Savchenko *In its* USSR Rept.: Transportation (JPRS-UTR-85-011) 7 Oct. 1985 p 12-16 Transl. into ENGLISH from Grazhdanskaya Aviats. (Moscow), no. 4, Apr. 85 p 26-27 (For primary document see N86-11177 02-01)
Avail: NTIS HC A06

N86-11181# Joint Publications Research Service, Arlington, Va.
WORLD'S LARGEST AIRPLANE NOW BEING TESTED
N. Dombkovskiy *In its* USSR Rept.: Transportation (JPRS-UTR-85-011) 7 Oct. 1985 p 17-20 Transl. into ENGLISH from TRUD (Moscow), 23 May 1985 p 3 (For primary document see N86-11177 02-01)
Avail: NTIS HC A06

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography.*

No abstracts in this category.

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N86-11201# Naval Postgraduate School, Monterey, Calif.
A NOVEL OSCILLATING JET: ITS EFFECT ON EJECTOR THRUST AUGMENTATION Technical Report, Aug. 1984 - Jan. 1985
M. A. BadriNarayanan, M. F. Platzer, and E. Rickenbaker May 1985 39 p
(AD-A157480; NPS67-85-005) Avail: NTIS HC A03/MF A01 CSCL 21/5

A plane subsonic turbulent jet was excited by a special oscillating nozzle. Its overall performance compares favorably with that of the vane excited jet investigated earlier. The nozzle when installed in an ejector system yielded a thrust augmentation ratio of 1.6 at an excitation frequency of 20 Hz. The dynamics of the oscillating flow was examined in the light of the Korst theory. GRA

N86-11202# Garrett Turbine Engine Co., Phoenix, Ariz.
LOW-COST, NET-SHAPE CERAMIC RADIAL TURBINE PROGRAM Final Technical Report, 1 Feb. 1981 - 31 Dec. 1984
D. W. Richerson and J. R. Smyth May 1985 163 p
(Contract DAAG46-81-C-0006)
(AD-A157532; Rept-21-5541; AMMRC-Tr-85-2) Avail: NTIS HC A08/MF A01 CSCL 11/2

This program's technical objective was to establish an injection-molded sintered silicon nitride manufacturing process to produce net-shape ceramic radial turbine rotors with high-temperature properties suitable for operation at tip speeds of 2000 feet per second and turbine inlet temperatures of 2500 F. The program consisted of: (1) screening 14 different sintered Si3N4 compositions; (2) process optimization and rotor fabrication; and (3) rotor stress analysis and rotor spin testing. A composition of 92% Si3N4 - 6% Y2O3 - 2% Al2O3 was developed with room temperature strength in excess of the 90 ksi program goal. A second composition was developed with room temperature and 2250 F strength in excess of the 90 ksi and 80 ksi program goals respectively. The TO2 turbocharger rotors were fabricated from the improved materials and exhibited burst speeds during spin testing up to 212,000 rpm. The burst speeds were lower than were predicted analytically based on the test bar strength data. Surface defects such as knit lines and cracks were consistently present in the rotors and possibly contributed to the low burst speed. GRA

N86-11148# Lockheed-Georgia Co., Marietta. Advanced Concepts Dept.
A REVIEW OF ADVANCED TURBOPROP TRANSPORT ACTIVITIES
Roy H. Lange *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 16 p refs (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

N86-11149# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
AERODYNAMIC METHOD USED IN FRANCE FOR ADVANCED FAST PROPELLER STUDY
J. M. Bousquet *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 15 p refs In FRENCH; ENGLISH summary Original language document previously announced in IAA as A85-15840 (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

N86-11150# Centre National de la Recherche Scientifique, Orsay (France).
DESIGN CONCEPT AND PERFORMANCE PREDICTION TECHNIQUE FOR POTENTIAL FLOWS AROUND ADVANCED PROPELLERS
Thoai-Sum Luu and Ranjit Collercandy *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 12 p refs (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

N86-11151# Aircraft Research Association Ltd., Bedford (England).
A REVIEW OF ARA RESEARCH INTO PROPELLER AERODYNAMIC PREDICTION METHODS
A. J. Bocci and J. I. Morrison *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 19 p refs (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

N86-11152# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
MODERN PROPELLER PROFILES
A. M. Rodde, J. J. Cuny (Societe Ratier Figeac, France), and J. J. Thibert *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 12 p refs In FRENCH Original language document previously announced in IAA as A85-15841 (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

N86-11153# National Aerospace Lab., Amsterdam (Netherlands).
AERODYNAMICS OF WIDE-CHORD PROPELLERS IN NON-AXISYMMETRIC FLOW
J. B. H. M. Schulten *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 10 p refs (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

N86-11154# Cranfield Inst. of Tech., Bedford (England). Coll. of Aeronautics.
ON THE AERODYNAMICS OF INSTALLED PROPELLERS
Martin E. Eshelby *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 15 p refs (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

N86-11155# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Entwurfsaerodynamik.
A UNIFIED APPROACH FOR THE AERODYNAMICS AND ACOUSTICS OF PROPELLERS IN FORWARD MOTION
A. Das *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 28 p refs (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

N86-11156*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THEORETICAL ANALYSIS OF LINEARIZED ACOUSTICS AND AERODYNAMICS OF ADVANCED SUPERSONIC PROPELLERS
F. Farassat *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 15 p refs (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01 CSCL 01A

N86-11157# Lockheed-California Co., Burbank.
A GENERAL THEORY OF ARBITRARY MOTION AERODYNAMICS USING AN AEROACOUSTIC APPROACH
Lyle N. Long and George A. Watts *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 12 p refs (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

N86-11158*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SUMMARY OF RECENT NASA PROPELLER RESEARCH
Daniel C. Mikkelson, Glenn A. Mitchell, and Lawrence J. Bober *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 24 p refs Previously announced as N84-32344 (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01 CSCL 01A

N86-11159# Societe Nationale Industrielle Aerospatiale, Marignane (France).
DYNAMIC BEHAVIOR OF A PROPFAN
J. M. Besson and D. Petot (ONERA, Paris) *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 15 p refs In FRENCH Original language document previously announced in IAA as A85-15842 (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

N86-11160# De Havilland Aircraft Co. of Canada Ltd., Downsview (Ontario).
PERFORMANCE EVALUATION OF FULL SCALE PROPELLERS BY WIND TUNNEL TEST
D. J. Barber *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 12 p refs (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

N86-11161# Institut de Mecanique des Fluides de Marseille (France).
STUDY OF THE 3D WAKE OF AN AERIAL PROPELLER [ETUDE DU SILLAGE 3D D'UNE HELICE AERIENNE]
D. Favier and C. Maresca *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 22 p refs In FRENCH (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

N86-11162# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
INVESTIGATIONS OF MODERN GENERAL AVIATION PROPELLERS
H. Zimmer, R. Hoffmann (Hoffmann-Propellers, Rosenheim, West Germany), and K. H. Horstmann (DFVLR, Brunswick) *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 14 p refs (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

N86-11163# Dowty Rotol Ltd., Gloucester (England).
AERODYNAMIC AND STRUCTURAL ASPECTS OF PROPELLER AND DRIVE FOR A 1/5 SCALE WIND TUNNEL PROGRAMME
R. M. Bass, B. Munniksma (National Aerospace Lab., Amsterdam), and J. vanHengst (Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost) *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 18 p refs (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

N86-11164# De Havilland Aircraft Co. of Canada Ltd., Downsview (Ontario).
SOME CONSIDERATIONS IN PROPELLER AND AIRFRAME INTEGRATION
B. Eggleston *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 11 p refs (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

N86-11165# Avions Marcel Dassault, Saint-Cloud (France). Div. des Etudes Avancees.
PROBLEMS OF THE INTEGRATION OF PROPELLERS IN AIRFRAMES, ESPECIALLY FOR HIGH PERFORMANCE TWIN-ENGINE AIRCRAFT [LES PROBLEMES D'INTEGRATION DE HELICES A LA CELLULE D'UN AVION ET, PLUS PARTICULIEREMENT, D'UN BIMOTEUR DE FORTE PUISSANCE]
Rene Taisserie *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 10 p In FRENCH (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

N86-11166# Lockheed-Georgia Co., Marietta.
WIND TUNNEL INVESTIGATION OF THE INTERACTION OF PROPELLER SLIPSTREAM WITH NACELLE/WING/FLAP COMBINATIONS
A. S. Aljabri and A. C. Hughes *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 10 p refs (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

N86-11167*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AN ASYMPTOTIC THEORY FOR THE INTERFERENCE OF LARGE ASPECT RATIO SWEPT WINGS AND MULTIPLE PROPELLER SLIPSTREAMS
R. K. Prabhu (Old Dominion Univ.), C. H. Liu, and S. N. Tiwari (Old Dominion Univ.) *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 17 p refs (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01 CSCL 01A

N86-11168# Carleton Univ., Ottawa (Ontario). Dept. of Mechanical and Aeronautical Engineering.
DEVELOPMENT OF MODERN TURBOPROP ENGINES
H. I. H. Saravanamuttoo *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 9 p refs (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

N86-11170# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.
SOME AEROACOUSTIC WIND TUNNEL MEASUREMENTS, THEORETICAL PREDICTIONS, AND FLIGHT-TEST CORRELATIONS ON SUBSONIC AIRCRAFT PROPELLERS
W. J. G. Trebble, J. Williams (Southampton Univ., England), and R. P. Donnelly (Dowty Rotol Ltd, Gloucester, England) *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 21 p refs (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

N86-11512*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMBUSTION HOT SECTION TECHNOLOGY
David B. Ercegovic *In its* Turbine Eng. Hot Sect. Technol. (HOST) Oct. 1983 p 129-133 refs (For primary document see N86-11495 02-39)
Avail: NTIS HC A11/MF A01 CSCL 21E

N86-11513*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HOST STRUCTURAL ANALYSIS PROGRAM OVERVIEW
R. H. Johns *In its* Turbine Eng. Hot Sect. Technol. (HOST) Oct. 1983 p 153-158 (For primary document see N86-11495 02-39)
Avail: NTIS HC A11/MF A01 CSCL 21E

N86-11515*# General Electric Co., Cincinnati, Ohio.
COMPONENT-SPECIFIC MODELING
M. L. Roberts *In* NASA. Lewis Research Center Turbine Eng. Hot Sect. Technol. (HOST) Oct. 1983 p 165-173 (For primary document see N86-11495 02-39)
(Contract NAS3-23687)
Avail: NTIS HC A11/MF A01 CSCL 21E

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N86-11203*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PRELIMINARY DESIGN STUDY OF A LATERAL-DIRECTIONAL CONTROL SYSTEM USING THRUST VECTORING
Frederick J. Lallman Nov. 1985 51 p refs
(NASA-TM-86425; L-15990; NAS 1.15:86425) Avail: NTIS HC A04/MF A01 CSCL 01C

A preliminary design of a lateral-directional control system for a fighter airplane capable of controlled operation at extreme angles of attack is developed. The subject airplane is representative of a modern twin-engine high-performance jet fighter, is equipped with ailerons, rudder, and independent horizontal-tail surfaces. Idealized bidirectional thrust-vectoring engine nozzles are appended to the mathematic model of the airplane to provide additional control moments. Optimal schedules for lateral and directional pseudo control variables are calculated. Use of pseudo controls results in coordinated operation of the aerodynamic and thrust-vectoring controls with minimum coupling between the lateral and directional airplane dynamics. Linear quadratic regulator designs are used to specify a preliminary flight control system to improve the stability and response characteristics of the airplane. Simulated responses to step pilot control inputs are stable and well behaved. For lateral stick deflections, peak stability axis roll rates are between 1.25 and 1.60 rad/sec over an angle-of-attack range of 10 deg to 70 deg. For rudder pedal deflections, the roll rates accompanying the sideslip responses can be arrested by small lateral stick motions. E.A.K.

N86-11204*# Calspan Advanced Technology Center, Buffalo, N.Y.
MISSION-ORIENTED REQUIREMENTS FOR UPDATING MIL-H-8501: CALSPAN PROPOSED STRUCTURE AND RATIONALE Final Report
Charles R. Chalk and Robert C. Radford Sep. 1985 294 p refs (Contract NAS2-11303; DA Proj. 1L1-62209-AH-76-A)
(NASA-CR-177371; USAAVSCOM-TR-85-A-7; NAS 1.26:177371; Calspan-Rept-7097-F-1) Avail: NTIS HC A13/MF A01 CSCL 01C

This report documents the effort by Arvin/Calspan Corporation to formulate a revision of MIL-H-8501A in terms of Mission-Oriented Flying Qualities Requirements for Military Rotorcraft. Emphasis is placed on development of a specification structure which will permit addressing Operational Missions and Flight Phases, Flight Regions, Classification of Required Operational Capability, Categorization of Flight Phases, and Levels of Flying Qualities. A number of definitions is established to permit addressing the rotorcraft state, flight envelopes, environments, and the conditions under which degraded flying qualities are permitted. Tentative requirements are drafted for Required Operational Capability Class 1. Also included is a Background Information and Users Guide for the draft specification structure proposed for the MIL-H-8501A revision. The report also contains a discussion of critical data gaps and attempts to prioritize these data gaps and to suggest experiments that should be performed to generate data needed to support formulation of quantitative design criteria for the additional Operational Capability Classes 2, 3, and 4. Author

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N86-11205 Communications Research Centre, Ottawa (Ontario). Space Technology and Applications Branch.

CRC CONTROL SYSTEMS LABORATORY GYRO TEST FACILITY
W. S. McMath and S. K. Yeung Apr. 1985 21 p
(CRC-1385) Avail: Issuing Activity

The gyro test facility was developed to provide a high precision testing capability, with the versatility to simulate, monitor and analyze the performance of a wide variety of sensors. The technical features of the facility as it was developed in parallel with a Single-Degree-of-Freedom (SDOF) gyro test program are summarized. Some of the data from that test program is included as a working example of facility capability. However, the details of the complete gyro evaluation will be covered in a separate report. Author

N86-11206*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
WATER TUNNEL FLOW VISUALIZATION USING A LASER
Christine Beckner and Robert E. Curry Oct. 1985 16 p refs Presented at the 3rd AIAA Appl. Aerodyn. Conf., Colorado Springs, 14-16 Oct. 1985
(NASA-TM-86743; H-1307; NAS 1.15:86743) Avail: NTIS HC A02/MF A01 CSCL 14B

Laser systems for flow visualization in water tunnels (similar to the vapor screen technique used in wind tunnels) can provide two-dimensional cross-sectional views of complex flow fields. This parametric study documents the practical application of the laser-enhanced visualization (LEV) technique to water tunnel testing. Aspects of the study include laser power levels, flow seeding (using flourescent dyes and embedded particulates), model preparation, and photographic techniques. The results of this study are discussed to provide potential users with basic information to aid in the design and setup of an LEV system. Author

N86-11207*# Boeing Aerospace Co., Seattle, Wash.
LASER ANGLE SENSOR
C. R. Pond and P. D. Texeira Sep. 1985 184 p refs
(Contract NAS1-16546)
(NASA-CR-172369; NAS 1.26:172369) Avail: NTIS HC A09/MF A01 CSCL 20E

A laser angle measurement system was designed and fabricated for NASA Langley Research Center. The instrument is a fringe counting interferometer that monitors the pitch attitude of a model in a wind tunnel. A laser source and detector are mounted above the model. Interference fringes are generated by a small passive element on the model. The fringe count is accumulated and displayed by a processor in the wind tunnel control room. This report includes optical and electrical schematics, system maintenance and operation procedures. Author

N86-11208*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
VISUAL AND MOTION CUEING IN HELICOPTER SIMULATION
Richard S. Bray Sep. 1985 19 p refs
(NASA-TM-86818; Rept-85371; NAS 1.15:86818) Avail: NTIS HC A02/MF A01 CSCL 14B

Early experience in fixed-cockpit simulators, with limited field of view, demonstrated the basic difficulties of simulating helicopter flight at the level of subjective fidelity required for confident evaluation of vehicle characteristics. More recent programs, utilizing large-amplitude cockpit motion and a multiwindow visual-simulation system have received a much higher degree of pilot acceptance. However, none of these simulations has presented critical visual-flight tasks that have been accepted by the pilots as the full equivalent of flight. In this paper, the visual cues presented in the simulator are compared with those of flight in an attempt to identify deficiencies that contribute significantly to these assessments. For the low-amplitude maneuvering tasks normally associated with the hover mode, the unique motion capabilities of the Vertical Motion Simulator (VMS) at Ames Research Center permit nearly a full representation of vehicle motion. Especially appreciated in these tasks are the vertical-acceleration responses to collective control. For larger-amplitude maneuvering, motion fidelity must suffer diminution through direct attenuation through high-pass filtering washout of the computer cockpit accelerations or both. Experiments were conducted in an attempt to determine the effects of these distortions on pilot performance of height-control tasks. Author

N86-11209*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AIRFLOW CALIBRATION OF A BELLMOUTH INLET FOR MEASUREMENT OF COMPRESSOR AIRFLOW IN TURBINE-POWERED PROPULSION SIMULATORS
Stephen C. Smith Nov. 1985 17 p refs
(NASA-TM-84399; Rept-85337; NAS 1.15:84399) Avail: NTIS HC A02/MF A01 CSCL 14B

The development of turbine-powered propulsion simulators for high-speed wind tunnel models requires a bellmouth inlet which can accurately measure compressor-inlet airflow. A bellmouth inlet was instrumented with total pressure probes, static pressure probes, and thermocouples for airflow measurement. The bellmouth flowmeter against a critical venturi flowmeter was calibrated. The calibration was done at four inlet pressures ranging from 58 to 114 kPa. The bellmouth discharge coefficient varied as a function of bellmouth-throat Mach number. Over the range of Reynolds number and Mach number tested the Reynolds number was not a significant influence on the discharge coefficient. The overall accuracy of the bellmouth inlet as a flowmeter was estimated to be + or - 0.5% of the flowmeter reading. E.A.K.

N86-11210# Engineering and Economics Research, Inc., Vienna, Va.
ENHANCED AIRPORT SURFACE DETECTION EQUIPMENT APPLICATIONS
H. R. Schramm 17 Apr. 1985 72 p
(AD-A157641) Avail: NTIS HC A04/MF A01 CSCL 17/7

The National Airspace Review (NAR) Enhancement Program is a cooperative government/industry effort to review airspace allocations and the procedural and regulatory aspects of scheduled improvements envisioned under the National Airspace System (NAS) Plan as well as other plans. Its purpose is to identify long-term operational considerations of enhanced systems as they evolve. Improved capabilities resulting from equipment already developed or in the process of development will be examined, with attention being focused on operational considerations rather than specific generation of system requirements. Task Group 4-6.1 of the NAR Enhancement Program convened in Washington, D.C., from January 8 to 10, 1985, and January 29, 1985. This task group was responsible for reviewing and analyzing operational considerations based on the development of enhanced airport surface detection equipment. The recommendations contained herein will be submitted to the Administrator, Federal Aviation Administration, through the NAR Enhancement Executive Steering Committee (EXCOM), for consideration and disposition. GRA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

No abstracts in this category.

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N86-11211 Texas Univ., Austin.
COMPUTATIONAL ERRORS AND THEIR CONTROL IN THE

DETERMINATION OF SATELLITE ORBITS Ph.D. Thesis
John Bernard Lindberg 1984 284 p
Avail: Univ. Microfilms Order No. DA8513257

Numerical integration errors are caused by a polynomial approximation of a nonlinear function and by the use of finite computer word length. Numerical integration errors may be expected to grow in a nearly quadratic or exponential manner for the satellite problem, and they become severe for long orbital trajectories. To reduce the problem of numerical integration error in the orbit determination process, certain techniques may be employed. One option to reduce integration error is the use of an increased computer word size in the computations; another is to employ techniques which do not require a change in the computer word size. The techniques under investigation were the use of the Encke method that reformulates the differential equations to reduce roundoff error, the use of empirical model parameters to compensate for some of the numberical integration error, and the modification of the integration process to reduce the errors caused by discontinuities in the force model with emphasis on the force due to solar radiation pressure. It is indicated that the effect of numerical integration error on the batch estimation process can be reduced significantly, and provide for convergence in fewer iterations with a smaller contribution to the overall error. Numerical integration error may be reduced with only a fraction of the cost compared to increasing the computer word size. Dissert. Abstr.

N86-11212*# Ohio State Univ., Columbus. ElectroScience Lab.
CALCULATION OF ALLOWABLE ORBITAL SPACINGS FOR THE FIXED-SATELLITE SERVICE
Yoshikazu Yamamura and Curt A. Levis Jul. 1985 78 p refs
(Grant NAG3-159)
(NASA-CR-176273; NAS 1.26:176273; TR-716548-1) Avail: NTIS HC A05/MF A01 CSCL 22A

Minimum satellite separations are calculated which satisfy a given carrier-to-interference protection ratio for the Fixed-Satellite Service (FSS) on a single-entry basis, assuming circular antenna beams. The results are presented in the form of universal contour curves, in which antenna-centered angles are the coordinates, and also in terms of the more conventional longitude and latitude separations. It is shown that orbit capacity increases with decreasing service-area size and that, for practical service areas, capacity is increased if the longitude of a satellite does not differ too greatly from that of the service area it serves. Author

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air).*

N86-11213# Naval Postgraduate School, Monterey, Calif.
A FLASH X-RAY FACILITY FOR THE NAVAL POSTGRADUATE SCHOOL
X. K. Maruyama and E. C. Zurey, Jr. Jun. 1985 18 p
(AD-A157278; NPS61-85-004) Avail: NTIS HC A02/MF A01 CSCL 20/7

A Pulsar Model 112A flash X-ray machine has been acquired by the Naval Postgraduate School. This brief report describes the technical aspects of the accelerator and provides documentation so that interested and affected parties may be informed on safety precautions, potential uses and practical considerations for the effective utilization of a major resource for education and research. GRA

N86-11214# Los Alamos Scientific Lab., N. Mex.
RAILGUN POWER SUPPLY SYSTEM UTILIZING TRACTION MOTORS AND VACUUM INTERRUPTERS
W. M. Parsons, J. V. Parker, and P. Thullen 1985 4 p Presented at the 5th IEEE Pulsed Power Conf., Washington, D.C., 10 Jun. 1985
(Contract W-7405-eng-36)
(DE85-014123; LA-UR-85-2022; CONF-850616-60) Avail: NTIS HC A02/MF A01

A railgun power supply has been designed that utilizes traction motors, vacuum interrupters and pulse transformers. An assembly of 28 traction motors, which store approximately 75 MJ, energize the primary windings of three pulse transformers at a peak current of 50 kA. At peak current an array of vacuum interrupters disconnects the transformer primary windings and forces the current to flow in the secondary windings. The secondary windings are connected directly to the railgun and require no opening switches. By staging the vacuum interrupter openings, a 1 MA to 1.3 MA ramped current waveform can be delivered to the railgun. DOE

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N86-11215*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PROBLEMS EXPERIENCED AND ENVISIONED FOR DYNAMICAL PHYSICAL SYSTEMS
Robert S. Ryan Aug. 1985 148 p refs
(NASA-TP-2508; M-494; NAS 1.60:2508) Avail: NTIS HC A07/MF A01 CSCL 22B

The use of high performance systems, which is the trend of future space systems, naturally leads to lower margins and a higher sensitivity to parameter variations and, therefore, more problems of dynamical physical systems. To circumvent dynamic problems of these systems, appropriate design, verification analysis, and tests must be planned and conducted. The basic design goal is to define the problem before it occurs. The primary approach for meeting this goal is a good understanding and reviewing of the problems experienced in the past in terms of the system under design. This paper reviews many of the dynamic problems experienced in space systems design and operation, categorizes them as to causes, and envisions future program implications, developing recommendations for analysis and test approaches. Author

N86-11216*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
HEAVY LIFT LAUNCH VEHICLES FOR 1995 AND BEYOND
Ronald Toelle, comp. Sep. 1985 149 p refs
(NASA-TM-86520; NAS 1.15:86520) Avail: NTIS HC A07/MF A01 CSCL 22B

A Heavy Lift Launch Vehicle (HLLV) designed to deliver 300,000 lb to a 540 n mi circular polar orbit may be required to meet national needs for 1995 and beyond. The vehicle described herein can accommodate payload envelopes up to 50 ft diameter by 200 ft in length. Design requirements include reusability for the more expensive components such as avionics and propulsion systems, rapid launch turnaround time, minimum hardware inventory, stage and component flexibility and commonality, and low operational costs. All ascent propulsion systems utilize liquid propellants, and overall launch vehicle stack height is minimized while maintaining a reasonable vehicle diameter. The ascent propulsion systems are based on the development of a new liquid oxygen/hydrocarbon booster engine and liquid oxygen/liquid hydrogen upper stage engine derived from today's SSME technology. Wherever possible, propulsion and avionics systems are contained in reusable propulsion/avionics modules that are recovered after each launch. Author

N86-11217# General Accounting Office, Washington, D. C. National Security and International Affairs Div.
STATUS OF THE INTERCONTINENTAL BALLISTIC MISSILE

MODERNIZATION PROGRAM
8 Jul. 1985 35 p
(AD-A157375; GAO/NSIAD-85-78) Avail: NTIS HC A03/MF A01 CSCL 16/4

The Department of Defense is taking three major actions to modernize the intercontinental ballistic missile component of the U.S. strategic forces. Specifically, DOD is: (1) developing a small ICBM and its hard mobile launcher, (2) researching other basing technology, and (3) deploying Peacekeeper (MX) missiles in Minuteman silos. Potential major issues of the small ICBM can now be identified. For instance, for a 500 missile force on hard mobile launchers: (1) life cycle cost would be about $44 billion in 1982 dollars, (2) personnel requirements would be about 20, 000 people, and (3) up to 28,000 square miles of land would be required for wartime operations. The Peacekeeper program is in production while development testing continues. Results to date have been positive. Current congressional action to limit the number of missiles deployed will affect program cost and schedule. GRA

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation, e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N86-11218*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NASA LEWIS RESEARCH CENTER LOW-GRAVITY FLUID MANAGEMENT TECHNOLOGY PROGRAM
John C. Aydelott, Michael J. Carney, and John I. Hochstein (Washington Univ., St. Louis) Nov. 1985 56 p refs Presented at the JANNAF Safety and Environ. Protection Subcomm. Meeting, Monterey, Calif., 4-7 Nov. 1985 and at the AIAA/GNOS 3rd Ann. Aerospace Technol. Symp., New Orleans, 7-8 Nov. 1985
(NASA-TM-87145; E-2774; NAS 1.15:87145; AIAA/GNOS-85-002) Avail: NTIS HC A04/MF A01 CSCL 22B

A history of the Lewis Research Center in space fluid management technology program is presented. Current programs which include numerical modeling of fluid systems, heat exchanger/ radiator concept studies, and the design of the Cryogenic Fluid Management Facility are discussed. Recent analytical and experimental activities performed to support the Shuttle/Centaur development activity are highlighted. Author

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications.*

No abstracts in this category.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support.* For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics.*

N86-11219 California Univ., Los Angeles.
A DIRECT MODEL REFERENCE ADAPTIVE APPROACH TO THE CONTROL OF SPACE STATIONS Ph.D. Thesis
Che-Hang Charles Ih 1985 306 p
Avail: Univ. Microfilms Order No. DA8513126

Of all large space structural systems, space stations present a unique challenge and requirement to advanced control technology. During shuttle docking the system mass may suddenly increase by more than 100% and during station assembly the mass may vary even more drastically. Large space structural systems require highly sophisticated control systems that can grow as the stations evolve and cope with the uncertainities and time-varying elements to maintain the stability and pointing of the space stations. This dissertation first deals with the aspects of space station operational properties including configurations, dynamic models, shuttle docking contact dynamics, solar panel interaction and load reduction to yield a set of system models and conditions. A model reference adaptive control algorithm along with the inner-loop plant augmentation design for controlling the space stations under severe operational conditions of shuttle docking, excessive model parameter errors, and model truncation are then investigated.DOE

N86-11220*# Columbia Univ., New York. Dept. of Civil Engineering and Engineering Mechanics.
VIBRATIONS AND STRUCTUREBORNE NOISE IN SPACE STATION Progress Report, 1 Jan. - 30 Jun. 1985
Rimas Vaicaitis 30 Jun. 1985 26 p refs
(Grant NAG1-541)
(NASA-CR-176291; NAS 1.26:176291) Avail: NTIS HC A03/MF A01 CSCL 22B

The related literature was reviewed and a preliminary analytical model was developed for simplified acoustic and structural geometries for pressurized and unpressurized space station modules. In addition to the analytical work, an experimental program on structureborne noise generation and transmission was started. A brief review of those accomplishments is given. Author

N86-11221*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DESIGN AND PERFORMANCE ANALYSIS OF AN AERO-MANEUVERING ORBITAL-TRANSFER VEHICLE CONCEPT
Gene P. Menees Oct. 1985 16 p refs
(NASA-TM-86848; Rept-85398; NAS 1.15:86848) Avail: NTIS HC A02/MF A01 CSCL 22B

Systems requirements for design-optimized, lateral-turn performance were determined for reusable, space-based applications and low-Earth orbits involving large multiple plane-inclination changes. The aerothermodynamic analysis is the most advanced available for rarefield-hypersonic flow over lifting surfaces at incidence. The effects of leading-edge bluntness, low-density viscous phenomena, and finite-rate flow-field chemistry and surface catalysis are accounted for. The predicted aerothermal heating characteristics are correlated with thermal-control and flight-performance capabilities. The mission payload capacity for delivery, retrieval, and combined operations was determined for round-trip sorties extending to polar orbits. Recommendations are given for future design refinements. The results help to identify technology issues required to develop prototype operational vehicles. Author

N86-11222*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPACEWARN BULLETIN
31 Aug. 1985 7 p
(NASA-TM-87512; NAS 1.15:87512; SPX-382) Avail: NTIS HC A02/MF A01 CSCL 22A

SPACEWARN Bulletin SPX-382, Aug. 31, 1985, lists international satellite and space probe launch events which occurred from July 31 until the end of August 1985. The Bulletin serves as an international communication mechanism for the rapid distribution of information on satellites and space probes, and is guided by COSPAR (Committee on Space Research) directives. F.M.R.

N86-11223# Los Alamos Scientific Lab., N. Mex.
ACTIVATED RECOMBINATIVE DESORPTION: A POTENTIAL COMPONENT IN MECHANISMS OF SPACECRAFT GLOW
J. B. Cross 1985 10 p Presented at the 2nd Workshop on Spacecraft Glow, Huntsville, Ala., 17 Jun. 1985
(Contract W-7405-eng-36)
(DE85-014092; LA-UR-85-2182; CONF-8506145-1) Avail: NTIS HC A02/MF A01

The concept of activated recombination of atomic species on surfaces is capable of explaining the production of vibrationally and translationally excited desorbed molecular species. Equilibrium statistical mechanics predicts that the molecular quantum state distributions of desorbing molecules is a function of only the surface temperature when the adsorption probability is unity and independent of initial collision conditions. In most cases though the adsorption probability is dependent upon initial conditions such as collision energy or internal quantum state distribution of impinging molecules. From detailed balance, such dynamical behavior is reflected in the internal quantum state distribution of the desorbing molecule. A number of surface-atom recombination systems demonstrate this nonthermal behavior: H2-Cu,N2-Fe,CO2-Pt, etc. It is proposed that this concept, activated recombinative desorption, may offer a common thread in proposed mechanisms of spacecraft glow. Ground-based experiments are proposed which will complement flight investigations probing the mechanism of the flow phenomenon. DOE

N86-11920# Joint Publications Research Service, Arlington, Va.
DESIGN OF MANEUVERABLE TRAJECTORIES OF RE-ENTRY VEHICLE Abstract Only
Xanuyan Zhao *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-014) 2 May 1985 p 72 Transl. into ENGLISH from Yuhang Xuebao (Beijing), no. 1, 31 Jan. 1985 p 1-10 Original language document announced in IAA as A85-42776 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography.*

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N86-11224*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN EXPERIMENTAL STUDY OF ENERGY LOSS MECHANISMS AND EFFICIENCY CONSIDERATION IN THE LOW POWER dc ARCJET
Francis M. Curran 1985 24 p refs Presented at the 18th Intern. Elec. Propulsion Conf., Alexandria, Va., 30 Sep. - 2 Oct. 1985; sponsored by AIAA, JSASS, and DGLR
(NASA-TM-87123; E-2733; NAS 1.15:87123; AIAA-85-2017) Avail: NTIS HC A02/MF A01 CSCL 21C

The potential utility of the low power dc arcjet in auxiliary propulsion was investigated. It was indicated that improvements in the areas of stability, energy efficiency, reliability, and electrode erosion are necessary to obtain a useful device. A water-cooled arcjet simulator was tested to investigate both the energy loss mechanisms at the electrodes and the stability of different conventional arcjet configurations in the presence of a vortex flow field. It is shown that in certain configurations only 25 to 30% of the input energy is lost to the electrodes. It is also shown that vortex stabilization is not difficult to obtain in many cases at the flow rates used and that a careful starting procedure is effective in minimizing electrode damage. E.A.K.

N86-11225# RAND Corp., Santa Monica, Calif.
SOME EXAMPLES OF PROPULSION APPLICATIONS USING ANTIMATTER
B. W. Augenstein Jul. 1985 9 p refs Presented at the Antimatter Propulsion Workshop, Pasadena, Calif., 20-21 Jun. 1985
Avail: NTIS HC A02/MF A01

Macroapplications of antimatter and annihilation energies to various uses beyond very high energy physics, which presupposes the solution of basic production and storage problems is discussed. Propulsion applications identifiable missions which cannot be achieved conventionally are discussed. The use of annihilation energies provides ways to access effective exhaust velocities from 10 Km/sec to a major fraction of light velocity. The promise of antimatter is illustrated by considering a mix ratio r = amount of normal matter/amount of antimatter and calculating the effective attained temperature of the mixture as approx. 2 GeV/r. Ensuring that this mixing produces high temperatures and that the energy does not largely escape from the mix is the art of utilizing annihilation energies. The immediate product of nucleon-antinucleon annihilations is almost wholly pions. The subsequent reaction trains and the ultimate forms of the end products, their spectral attributes, the decay or capture mechanisms, are documented. E.A.K.

N86-11226# Naval Postgraduate School, Monterey, Calif.
PARTICLE SIZING IN A SOLID ROCKET MOTOR USING THE MANAGEMENT OF SCATTERED LIGHT M.S. Thesis
K. Abubakar Mar. 1985 63 p
(AD-A156480) Avail: NTIS HC A04/MF A01 CSCL 17/8

A previous study discussed the formulation of the theory for the scattering properties in the general case of particles of arbitrary size and refractive index occurring in a polydispersion of finite optical depth. Roberts and Webb concluded that the volume-surface mean diameter (Sauter) D sub 32 of the polydispersion may be determined from the intensity of diffraction scattered light from spherical particles. An experimental investigation was conducted to determine the feasibility of measuring the change in particle size across the exhaust nozzle of a small solid propellant rocket motor. Light scattering measurements were made at small forward angles at the entrance and exit of the exhaust nozzle. The experimental technique was found to be practical, especially if used in conjunction with measurements of transmitted light of multiple wave lengths. However, the determination of D sub 32 is difficult in the motor environment and is biased toward the larger particles in the size distribution. Particle size measurements were in reasonable agreement with sizes determined from collected exhaust products. GRA

N86-11921# Joint Publications Research Service, Arlington, Va.
ONE-DIMENSIONAL TWO-PHASE FLOW IN COMBUSTION CHAMBER OF SOLID PROPELLANT ROCKET MOTORS Abstract Only
Xianqi Chang *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-014) 2 May 1985 p 73 Transl. into ENGLISH from Yuhang Xuebao (Beijing), no. 1, 31 Jan. 1985 p 11-23 Original language document announced in IAA as A85-42777 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

N86-11925# Joint Publications Research Service, Arlington, Va.
THE ANALYSIS AND CALCULATION FOR THE DYNAMIC CHARACTERISTICS OF THE OMNI-AXIAL MOVABLE FLEXIBLE JOINT NOZZLE Abstract Only
Shixue Yang *In its* China Rept.: Sci. and Technol.

(JPRS-CST-85-014) 2 May 1985 p 77 Transl. into ENGLISH from Yuhang Xuebao (Beijing), no. 1, 31 Jan. 1985 p 59-77 Original language document announced in IAA as A85-42781 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N86-11227*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
WELDING, BONDING AND FASTENING, 1984
John D. Buckley, ed. and Bland A. Stein, ed. Washington Sep. 1985 484 p refs Conf. held in Hampton, Va., 23-25 Oct. 1984; sponsored by NASA, American Society for Metals, George Washington Univ., American Welding Society, and Society of Mfg. Engineers
(NASA-CP-2387; L-16023; NAS 1.55:2387) Avail: NTIS HC A21/MF A01 CSCL 13H

A compilation of papers presented in a joint NASA, American Society for Metals, The George Washington University, American Welding Soceity, and Society of Manufacturing Engineers conference on Welding, Bonding, and Fastening at Langley Research Center, Hampton, VA, on October 23 to 25, 1984 is given. Papers were presented on technology developed in current research programs relevant to welding, bonding, and fastening of structural materials required in fabricating structures and mechanical systems used in the aerospace, hydrospace, and automotive industries. Topics covered in the conference included equipment, hardware and materials used when welding, brazing, and soldering, mechanical fastening, explosive welding, use of unique selected joining techniques, adhesives bonding, and nondestructive evaluation. A concept of the factory of the future was presented, followed by advanced welding techniques, automated equipment for welding, welding in a cryogenic atmosphere, blind fastening, stress corrosion resistant fasteners, fastening equipment, explosive welding of different configurations and materials, solid-state bonding, electron beam welding, new adhesives, effects of cryogenics on adhesives, and new techniques and equipment for adhesive bonding. For individual titles, see N86-11228 through N86-11255.

N86-11228*# LTV Aerospace and Defense Co., Dallas, Tex. Vought Aero Products Div.
THE FACTORY OF THE FUTURE **c37**
J. E. Byman *In* NASA. Langley Research Center Welding, Bonding and Fastening, 1984 Sep. 1985 p 1-9 (For primary document see N86-11227 02-23)
Avail: NTIS HC A21/MF A01 CSCL 13H

A brief history of aircraft production techniques is given. A flexible machining cell is then described. It is a computer controlled system capable of performing 4-axis machining part cleaning, dimensional inspection and materials handling functions in an unmanned environment. The cell was designed to: allow processing of similar and dissimilar parts in random order without disrupting production; allow serial (one-shipset-at-a-time) manufacturing; reduce work-in-process inventory; maximize machine utilization through remote set-up; maximize throughput and minimize labor.
R.J.F.

N86-11229*# Arc Machines, Inc., Pacoima, Calif.
AUTOMATIC ORBITAL GTAW WELDING: HIGHEST QUALITY WELDS FOR TOMORROW'S HIGH-PERFORMANCE SYSTEMS **c37**
Barbara K. Henon *In* NASA. Langley Research Center Welding, Bonding and Fastening, 1984 Sep. 1985 p 11-19 (For primary document see N86-11227 02-32)
Avail: NTIS HC A21/MF A01 CSCL 13H

Automatic orbital gas tungsten arc welding (GTAW) or TIG welding is certain to play an increasingly prominent role in tomorrow's technology. The welds are of the highest quality and the repeatability of automatic weldings is vastly superior to that of manual welding. Since less heat is applied to the weld during automatic welding than manual welding, there is less change in the metallurgical properties of the parent material. The possibility of accurate control and the cleanliness of the automatic GTAW welding process make it highly suitable to the welding of the more exotic and expensive materials which are now widely used in the aerospace and hydrospace industries. Titanium, stainless steel, Inconel, and Incoloy, as well as, aluminum can all be welded to the highest quality specifications automatically. Automatic orbital GTAW equipment is available for the fusion butt welding of tube-to-tube, as well as, tube to autobuttweld fittings. The same equipment can also be used for the fusion butt welding of up to 6 inch pipe with a wall thickness of up to 0.154 inches. Author

N86-11230*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
INVESTIGATION OF LOW-TEMPERATURE SOLDERS FOR CRYOGENIC WIND TUNNEL MODELS Interim Report **c26**
George C. Firth and Vernon E. Watkins, Jr. *In its* Welding, Bonding and Fastening, 1984 Sep. 1985 p 21-34 refs (For primary document see N86-11227 02-23)
Avail: NTIS HC A21/MF A01 CSCL 11F

The advent of high Reynolds number cryogenic wind tunnels has forced alteration of manufacturing and assembly techniques and eliminated usage of many materials associated with conventional wind tunnel models. One of the techniques affected is soldering. Solder alloys commonly used for wind tunnel models are susceptible to low-temperature embrittlement and phase transformation. The low-temperature performance of several solder alloys is being examined during research and development activities being conducted in support of design and fabrication of cryogenic wind tunnel models. Among the properties examined during these tests are shear strength, surface quality, joint stability, and durability when subjected to dynamic loading. Results of these tests and experiences with recent models are summarized. Author

N86-11231*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
NTF: SOLDERING TECHNOLOGY DEVELOPMENT FOR CRYOGENICS **c26**
E. Thomas Hall, Jr. *In its* Welding, Bonding and Fastening, 1984 Sep. 1985 p 35-54 refs (For primary document see N86-11227 02-23)
Avail: NTIS HC A21/MF A01 CSCL 11F

The advent of the National Transonic Facility (NTF) brought about a new application for an old joining method, soldering. Soldering for use at cryogenic temperatures requires that solders remain ductile and free from tin-pest (grey tin), have toughness to withstand aerodynamic loads associated with flight research, and maintain their surface finishes. Solders are used to attach 347 Stainless-Steel tubing in surface grooves of models. The solder must fill up the gap and metallurgically bound to the tubing and model. Cryogenic temperatures require that only specific materials for models can be used, including: Vasco Max 200 CVM, Iescalloy A-286 Vac Arc, pH 13-8 Mo. Solders identified for testing at this time are: 50% Sn - 49.5% Pb - 0.5% Sb, 95% Sn - 5% Sb, 50% In 50% Pb, and 37.5% Sn - 37.5% Pb - 25% In. With these materials and solders, it is necessary to determine their solderability. After solderability is determined, tube/groove specimens are fabricated and stressed under cryogenic temperatures. Compatible solders are then used for acutual models. Author

N86-11232*# SPS Technologies, Jenkintown, Pa.
MECHANICAL FASTENERS FOR ADVANCED COMPOSITE MATERIALS **c37**
Richard C. Landt *In* NASA. Langley Research Center Welding, Bonding and Fastening, 1984 Sep. 1985 p 55-65 ref (For primary document see N86-11227 02-23)
Avail: NTIS HC A21/MF A01 CSCL 13E

Advanced composite materials, which are increasingly being used to build aircraft, have different properties than the metals

they replace. Fasteners intended for composite-material joints must be designed and selected to allow for these differences. For example, blind fasteners (one-sided access) used to assemble composite-to-composite joints have been redesigned to expand to larger diameters to resist pull-through and cocking failures. The fastener designs needed for composite materials are reviewed. Topics discussed are: galvanic corrosion, pull-through resistance, fastener rotation, installation damage, fastener galling and conductivity. A blind fastener recently developed by SPS Technologies is described to show how these requirements are incorporated.
Author

N86-11233*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THE ALTERNATING SURFACE SEGMENTED LAP JOINT: A DESIGN FOR THIN HIGHLY LOADED JOINTS c37
Vernon E. Watkins, Jr. and George C. Firth *In its* Welding, Bonding and Fastening, 1984 Sep. 1985 p 67-76 ref (For primary document see N86-11227 02-23)
Avail: NTIS HC A21/MF A01 CSCL 13E

The combination of thin airfoil sections and high aerodynamic loads on many wind tunnel models presents a major problem for attachment of flap elements. Conventional methods of attaching fixed control elements such as lap and tongue-in-groove joints are not rigid enough to provide surface continuity required in high Reynolds number research. For the extreme cases, the solution has been to fabricate separate wings for each flap setting with the flap element being and integral part of the wing. Here an attractive solution to this problem, the alternating surface segmented lap joint, is discussed. This joint provides increased rigidity and lower stress levels than conventional joints. Additionally, attachment fastener loading is low and the joint can be designed to accommodate high shear levels due to bending without the use of dowel pins.
Author

N86-11234*# Martin Marietta Aerospace, New Orleans, La.
AUTOMATIC FASTENING LARGE STRUCTURES: A NEW APPROACH c37
Donald F. Lumley *In* NASA. Langley Research Center Welding, Bonding and Fastening, 1984 Sep. 1985 p 77-88 (For primary document see N86-11227 02-23)
Avail: NTIS HC A21/MF A01 CSCL 13E

The external tank (ET) intertank structure for the space shuttle, a 27.5 ft diameter 22.5 ft long externally stiffened mechanically fastened skin-stringer-frame structure, was a labor intensitive manual structure built on a modified Saturn tooling position. A new approach was developed based on half-section subassemblies. The heart of this manufacturing approach will be 33 ft high vertical automatic riveting system with a 28 ft rotary positioner coming on-line in mid 1985. The Automatic Riveting System incorporates many of the latest automatic riveting technologies. Key features include: vertical columns with two sets of independently operating CNC drill-riveting heads; capability of drill, insert and upset any one piece fastener up to 3/8 inch diameter including slugs without displacing the workpiece offset bucking ram with programmable rotation and deep retraction; vision system for automatic parts program re-synchronization and part edge margin control; and an automatic rivet selection/handling system.
Author

N86-11235*# SPS Technologies, Jenkintown, Pa.
STRESS CORROSION RESISTANT FASTENERS c37
Thomas A. Roach *In* NASA. Langley Research Center Welding, Bonding and Fastening, 1984 Sep. 1985 p 89-104 (For primary document see N86-11227 02-23)
Avail: NTIS HC A21/MF A01 CSCL 13E

A family of high performance aerospace fasteners made from corrosion resistant alloys for use in applications where corrosion and stress-corrosion cracking are of major concern are discussed. The materials discussed are mainly A-286, Inconel 718, MP35N and MP159. Most of the fasteners utilize cold worked and aged materials to achieve the desired properties. The fasteners are unique in that they provide a combination of high strength and immunity to stress corrosion cracking not previously attainable. A discussion of fastener stress corrosion failures is presented including a review of the history and a description of the mechanism. Case histories are presented to illustrate the problems which can arise when material selection is made without proper regard for the environmental conditions. Mechanical properties and chemical compositions are included for the fasteners discussed. Several aspects of the application of high performance corrosion resistant fasteners are discussed including galvanic compatibility and torque-tension relationships.
Author

N86-11236*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DERIVATION AND TEST OF ELEVATED TEMPERATURE THERMAL-STRESS-FREE FASTENER CONCEPT c37
James Wayne Sawyer, Max L. Blosser, and Robert R. McWithey *In its* Welding, Bonding and Fastening, 1984 Sep. 1985 p 105-122 refs (For primary document see N86-11227 02-23)
Avail: NTIS HC A21/MF A01 CSCL 13E

Future aerospace vehicles must withstand high temperatures and be able to function over a wide temperature range. New composite materials are being developed for use in designing high-temperature lightweight structures. Due to the difference between coefficients of thermal expansion for the new composite materials and conventional high-temperature metallic fasteners, innovative joining techniques are needed to produce tight joints at all temperatures without excessive thermal stresses. A thermal-stress-free fastening technique is presented that can be used to provide structurally tight joints at all temperatures even when the fastener and joined materials have different coefficients of thermal expansion. The derivation of thermal-stress-free fasteners and joint shapes is presented for a wide variety of fastener materials and materials being joined together. Approximations to the thermal-stress-free shapes that result in joints with low-thermal-stresses and that simplify the fastener/joint shape are discussed. The low-thermal-stress fastener concept is verified by thermal and shear tests in joints using oxide-dispersion-strengthened alloy fasteners in carbon-carbon material. The test results show no evidence of thermal stress damage for temperatures up to 2000 F and the resulting joints carried shear loads at room temperature typical of those for conventional joints.
Author

N86-11237*# Battelle Columbus Labs., Ohio.
EXPLOSIVE WELDING IN THE 1990'S c37
Narain S. Lalwaney and Vonne D. Linse *In* NASA. Langley Research Center Welding, Bonding and Fastening, 1984 Sep. 1985 p 123-140 refs (For primary document see N86-11227 02-23)
Avail: NTIS HC A21/MF A01 CSCL 13H

Explosive bonding is a unique joining process with the serious potential to produce composite materials capable of fulfilling many of the high performance materials capable of fulfilling many of the high performance materials needs of the 1990's. The process has the technological versatility to provide a true high quality metallurgical compatible and incompatible systems. Metals routinely explosively bonded include a wide variety of combinations of reactive and refractory metals, low and high density metals and their alloys, corrosion resistant and high strength alloys, and common steels. The major advantage of the process is its ability to custom design and engineer composites with physical and/or mechanical properties that meet a specific or unusual performance requirement. Explosive bonding offers the designer unique opportunities in materials selection with unique combinations of properties and high integrity bonds that cannot be achieved by any other metal joining process. The process and some applications are discussed.
Author

N86-11238*# Explosive Fabricators, Inc., Louisville, Colo.
EXPLOSIVE WELDING OF TUBULAR CONFIGURATED JOINTS FOR CRITICAL APPLICATIONS c37
Roy Hardwick *In* NASA. Langley Research Center Welding, Bonding and Fastening, 1984 Sep. 1985 p 141-155 (For primary document see N86-11227 02-23)

Avail: NTIS HC A21/MF A01 CSCL 13H

Explosive welding can provide the answer to problems of permanently joining metals typically used in the aerospace industry. The explosive bonding process is a solid state bonding process enabling material incompatibility problems associated with fusion welding to be overcome. In addition, heat affected zones are eliminated thus, enhancing joint strength, properties and performance. The process requires the parts being joined to be impelled, by means of explosives, to collide with each other. Certain critical collision parameters must be met and controlled and these parameters are defined. Various component geometries which satisfy the collision parameters are described. Examples of transition joints used in the aerospace industry are described and illustrated. Author

N86-11239*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

EXPLOSIVE TUBE-TO-FITTING JOINING OF SMALL-DIAMETER TUBES c37

Laurence J. Bement *In its* Welding, Bonding and Fastening, 1984 Sep. 1985 p 157-175 (For primary document see N86-11227 02-23)

Avail: NTIS HC A21/MF A01 CSCL 13H

An effort is currently under way by NASA Marshall Space Flight Center to upgrade the space shuttle main engine through the use of improved materials and processes. Under consideration is the use of the Langley Research Center explosive seam welding process. The objective is to demonstrate the feasibility of joining space shuttle main engine tube to fitting components in an oxygen heat exchanger, using the NASA LaRC explosive seam welding process. It was concluded that LaRC explosive joining is viable for this application; that there is no incompatability of materials; that ultrasonic inspection is the best nondestructive testing method; and that the .500 DIA joint experiences interface problems. R.J.F.

N86-11240*# Foster Wheeler Corp., Livingston, N.J.

THE USE OF EXPLOSIVE FORMING FOR FASTENING AND JOINING STRUCTURAL AND PRESSURE COMPONENTS c37

J. Wayne Schroeder *In* NASA. Langley Research Center Welding, Bonding and Fastening, 1984 Sep. 1985 p 177-184 (For primary document see N86-11227 02-23)

Avail: NTIS HC A21/MF A01 CSCL 13H

Explosive expansion of tubes into tubesheets has been used for over 20 years in the fabrication and repair of shell and tube heat exchangers. The use of explosives to perform these expansions has offered several distinct advantages over other methods. First, the process is fast and economical and can be performed with minimal training of personnel. Secondly, explosive forming does not cause the deleterious metallurgical effects which often result from other forming operations. In addition, the process can be performed remotely without the need for sophisticated handling equipment. The expansion of tubes into tubesheets is only one of many possible fastening and joining applications for which explosive forming can be used to achieve highly successful results. The explosive forming process and where it has been used are described. In addition, some possible adaptations to other joining applications are identified and discussed. Author

N86-11241*# Helwan Univ., Cairo (Egypt).

EXPLOSIVE WELDING OF ALUMINUM, TITANIUM AND ZIRCONIUM TO COPPER SHEET METAL c37

Abdel-Aziz Hegazy and Jim D. Mote (Denver Univ.) *In* NASA. Langley Research Center Welding, Bonding and Fastening, 1984 Sep. 1985 p 185-196 refs (For primary document see N86-11227 02-23)

Avail: NTIS HC A21/MF A01 CSCL 13H

The main material properties affecting the explosive weldability of a certain metal combination are the yield strength, the ductility, the density and the sonic velocity of the two metals. Successful welding of the metal combination depends mainly on the correct choice of the explosive welding parameters; i.e., the stand off distance, the weight of the explosive charge relative to the weight of the flyer plate and the detonation velocity of the explosive. Based on the measured and the handbook values of the properties of interest, the explosive welding parameters were calculated and the arrangements for the explosive welding of the Al alloy 6061-T6, titanium and zirconium to OFHC copper were determined. The relatively small sheet metal thickness (1/8') and the fact that the thickness of the explosive layer must exceed a certain minimum value were considered during the determination of the explosive welding conditions. The results of the metallographic investigations and the measurements of the shear strength at the interface demonstrate the usefulness of these calculations to minimize the number of experimental trials. Author

N86-11242*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

NONDESTRUCTIVE ULTRASONIC MEASUREMENT OF BOLT PRELOAD USING THE PULSED-PHASE LOCKED-LOOP INTERFEROMETER c39

S. G. Allison and J. S. Heyman *In its* Welding, Bonding and Fastening, 1984 Sep. 1985 p 197-209 refs (For primary document see N86-11227 02-23)

Avail: NTIS HC A21/MF A01 CSCL 20K

Achieving accurate preload in threaded fasteners is an important and often critical problem which is encountered in nearly all sectors of government and industry. Conventional tensioning methods which rely on torque carry with them the disadvantage of requiring constant friction in the fastener in order to accurately correlate torque to preload. Since most of the applied torque typically overcomes friction rather than tensioning the fastener, small variations in friction can cause large variations in preload. An instrument called a pulsed phase locked loop interferometer, which was recently developed at NASA Langley, has found widespread use for measurement of stress as well as material properties. When used to measure bolt preload, this system detects changes in the fastener length and sound velocity which are independent of friction. The system is therefore capable of accurately establishing the correct change in bolt tension. This high resolution instrument has been used for precision measurement of preload in critical fasteners for numerous applications such as the space shuttle landing gear and helicopter main rotors. Author

N86-11243*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

LANGLEY RESEARCH CENTER STANDARD FOR THE EVALUATION OF SOCKET WELDS c38

Robert F. Berry, Jr. *In its* Welding, Bonding and Fastening, 1984 Sep. 1985 p 211-229 (For primary document see N86-11227 02-23)

Avail: NTIS HC A21/MF A01 CSCL 14D

A specification utilized for the nondestructive evaluation of socket type pipe joints at Langley Research Center (LaRC) is discussed. The scope of hardware shall include, but is not limited to, all common pipe fittings: tees, elbows, couplings, caps, and so forth, socket type flanges, unions, and valves. In addition, the exterior weld of slip on flanges shall be inspected using this specification. At the discretion of the design engineer, standard practice engineer, Fracture Mechanics Engineering Section, Pressure Systems Committee, or other authority, four nondestructive evaluation techniques may be utilized exclusively, or in combination, to inspect socket type welds. These techniques are visual, radiographic, magnetic particle, and dye penetrant. Under special circumstances, other techniques (such as eddy current or ultrasonics) may be required and their application shall be guided by the appropriate sections of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (B&PVC). Author

N86-11244*# Northrop Corp., Hawthorne, Calif. Aircraft Div.

SOLID-STATE BONDING OF SUPERPLASTIC ALUMINUM ALLOY 7475 SHEET c37

Thomas D. S. Byun and Ramsevak B. Vastava *In* NASA. Langley Research Center Welding, Bonding and Fastening, 1984 Sep. 1985 p 231-251 (For primary document see N86-11227 02-23)

Avail: NTIS HC A21/MF A01 CSCL 13H

Experimental works were carried out to study the feasibility of solid state bonding of superplastic aluminum 7475 sheet. Amount of deformation, bonding time, surface cleaning method and intermediate layer were the process parameters investigated. Other parameters, held constant by the superplastic forming condition which is required to obtain a concurrent solid state bonding, are bonding temperature, bonding pressure and atmosphere. Bond integrity was evaluated through metallographic examination, X-ray line scan analysis, SEM fractographic analysis and lap shear tests. The early results of the development program indicated that sound solid state bonding was accomplished for this high strength 7475 alloy with significant amounts of deformation. A thin intermediate layer of the soft 5052 aluminum alloy aided in achieving a solid state bonding by reducing the required amount of plastic deformation at the interface. Bond strength was substantially increased by a post bond heat treatment. Author

N86-11245*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

EVALUATION OF SUPERPLASTIC FORMING AND WELD-BRAZING FOR FABRICATION OF TITANIUM COMPRESSION PANELS **c37**

Dick M. Royster, Thomas T. Bales, and Randall C. Davis *In its* Welding, Bonding and Fastening, 1984 Sep. 1985 p 253-270 refs (For primary document see N86-11227 02-23)

Avail: NTIS HC A21/MF A01 CSCL 13H

The two titanium processing procedures, superplastic forming and weld brazing, are successfully combined to fabricate titanium skin stiffened structural panels. Stiffeners with complex shapes are superplastically formed using simple tooling. These stiffeners are formed to the desired configuration and required no additional sizing or shaping following removal from the mold. The weld brazing process by which the stiffeners are attached to the skins utilize spot welds to maintain alignment and no additional tooling is required for brazing. The superplastic formed/weld brazed panels having complex shaped stiffeners develop up to 60 percent higher buckling strengths than panels with conventional shaped stiffeners. The superplastic forming/weld brazing process is successfully scaled up to fabricate full size panels having multiple stiffeners. The superplastic forming/weld brazing process is also successfully refined to show its potential for fabricating multiple stiffener compression panels employing unique stiffener configurations for improved structural efficiency. Author

N86-11246*# Massachusetts Inst. of Tech., Cambridge.

FEASIBILITY OF REMOTELY MANIPULATED WELDING IN SPACE: A STEP IN THE DEVELOPMENT OF NOVEL JOINING TECHNOLOGIES **c37**

Koichi Masubuchi, John E. Agapakis, Andrew DeBiccari, and Christopher vonAlt *In* NASA. Langley Research Center Welding, Bonding and Fastening, 1984 Sep. 1985 p 271-296 refs (For primary document see N86-11227 02-23)

Avail: NTIS HC A21/MF A01 CSCL 13M

A six month research program entitled Feasibility of Remotely Manipulated Welding in Space - A Step in the Development of Novel Joining Technologies is performed at the Massachusetts Institute of Technology for the Office of Space Science and Applications, NASA, under Contract No. NASW-3740. The work is performed as a part of the Innovative Utilization of the Space Station Program. The final report from M.I.T. was issued in September 1983. This paper presents a summary of the work performed under this contract. The objective of this research program is to initiate research for the development of packaged, remotely controlled weiding systems for space construction and repair. The research effort includes the following tasks: (1) identification of probable joining tasks in space; (2) identification of required levels of automation in space welding tasks; (3) development of novel space welding concepts; (4) development of recommended future studies; and (5) preparation of the final report. Author

N86-11247*# Douglas Aircraft Co., Inc., Long Beach, Calif.

ADVANCES IN JOINING TECHNIQUES USED IN DEVELOPMENT OF SPF/DB TITANIUM SANDWICH REINFORCED WITH METAL MATRICES **c37**

J. E. Fischler *In* NASA. Langley Research Center Welding, Bonding and Fastening, 1984 Sep. 1985 p 297-322 (For primary document see N86-11227 02-23)

Avail: NTIS HC A21/MF A01 CSCL 13M

Three and four-sheet expanded titanium sandwich sheets have been developed at Douglas Aircraft Company, a division of McDonnell Douglas Corporation, under contract to NASA Langley Research Center. In these contracts, spot welding and roll seam welding are used to join the core sheets. These core sheets are expanded to the face sheets and diffusion bonded to form various type cells. The advantages of various cell shapes and the design parameters for optimizing the wing and fuselage concepts are discussed versus the complexity of the spot weld pattern. In addition, metal matrix composites of fibers in an aluminum matrix encapsulated in a titanium sheath are aluminum brazed successfully to the titanium sandwich face sheets. The strength and crack growth rate of the superplastic-formed/diffusion bonded (SPF/DB) titanium sandwich with and without the metal matrix composites are described. Author

N86-11248*# Texas Instruments, Inc., Attleboro, Mass.

COMPARISON OF BOND IN ROLL-BONDED AND ADHESIVELY BONDED ALUMINUMS **c38**

R. J. Schwensfeir, Jr., G. Trenkler, R. G. Delagi, and J. A. Forster *In* NASA. Langley Research Center Welding, Bonding and Fastening, 1984 Sep. 1985 p 323-338 refs (For primary document see N86-11227 02-23)

Avail: NTIS HC A21/MF A01 CSCL 14D

Lap-shear and peel test measurements of bond strength have been carried out as part of an investigation of roll bonding of 2024 and 7075 aluminum alloys. Shear strengths of the bonded material in the F temper are in the range of 14 to 16 ksi. Corresponding peel strengths are 120 to 130 lb/inch. These values, which are three to five times those reported in the literature for adhesively bonded 2024 and 7075, are a result of the true metallurgical bond achieved. The effects of heat-treating the bonded material are described and the improvements in bond strength discussed relative to the shear strength of the parent material. The significance of the findings for aerospace applications is discussed. Author

N86-11249*# Lockheed-Georgia Co., Marietta.

ADHESIVES FOR AEROSPACE **c27**

L. E. Meade *In* NASA. Langley Research Center Welding, Bonding and Fastening, 1984 Sep. 1985 p 339-349 refs (For primary document see N86-11227 02-23)

Avail: NTIS HC A21/MF A01 CSCL 11A

The industry is hereby challenged to integrate adhesive technology with the total structure requirements in light of today's drive into automation/mechanization. The state of the art of adhesive technology is fairly well meeting the needs of the structural designers, the processing engineer, and the inspector, each on an individual basis. The total integration of these needs into the factory of the future is the next collective hurdle to be achieved. Improved processing parameters to fit the needs of automation/mechanization will necessitate some changes in the adhesive forms, formulations, and chemistries. Adhesives have, for the most part, kept up with the needs of the aerospace industry, normally leading the rest of the industry in developments. The wants of the aerospace industry still present a challenge to encompass all elements, achieving a totally integrated joined and sealed structural system. Better toughness with hot-wet strength improvements is desired. Lower cure temperatures, longer out times, and improved corrosion inhibition are desired. Author

N86-11250*# Boeing Aerospace Co., Seattle, Wash.

HIGH-TEMPERATURE ADHESIVE DEVELOPMENT AND EVALUATION **c27**

Carl L. Hendricks and Jeremy N. Hale *In* NASA. Langley Research

Center Welding, Bonding and Fastening, 1984 Sep. 1985 p 351-370 refs (For primary document see N86-11227 02-23)
Avail: NTIS HC A21/MF A01 CSCL 11A

High-temperature adhesive systems are evaluated for short and long-term stability at temperatures ranging from 232C to 427C. The resins selected for characterization include: NASA Langley developed polyphenylquinoxaline (PPQ), and commercially available polyimides (PI). The primary method of bond testing is single lap shear. The PPQ candidates are evaluated on 6Al-4V titanium adherends with chromic acid anodize and phosphate fluoride etch surface preparations. The remaining adhesives are evaluated on 15-5 PH stainless steel with a sulfuric acid anodize surface preparation. Preliminary data indicate that the PPQ adhesives tested have stability to 3000 hours at 450F with chromic acid anodize surface preparation. Additional studies are continuing to attempt to improve the PPQ's high-performance by formulating adhesive films with a boron filler and utilizing the phosphate fluoride surface preparation on titanium. Evaluation of the polyimide candidates on stainless-steel adherends indicates that the FM-35 (American Cyanamid), PMR-15 (U.S. Polymeric/Ferro), TRW partially fluorinated polyimide and NR 150B2S6X (DuPont) adhesives show sufficient promise to justify additional testing. Author

N86-11251*# Martin Marietta Corp., Baltimore, Md.
USE OF HYDRATION INHIBITORS TO IMPROVE BOND DURABILITY OF ALUMINUM ADHESIVE JOINTS **c27**
G. D. Davis, J. S. Ahearn, L. J. Matienzo, and J. D. Venables *In* NASA. Langley Research Center Welding, Bonding and Fastening, 1984 Sep. 1985 p 371-396 refs Previously announced in IAA as A85-29979 (For primary document see N86-11227 02-23)
(Contract N00014-80-C-0718)
Avail: NTIS HC A21/MF A01 CSCL 11A

An investigation is conducted of the mechanisms by which nitrilotris methylene phosphonic acid (NTMP) and related compounds are adsorbed onto oxidized aluminum surfaces to inhibit hydration and increase the durability of adhesive bonds formed with inhibitor-treated panels. P - O - Al bonds are identified as the basis of adsorption, and it is found that water initially adsorbed onto the etched aluminum surfaces is displaced by the NTMP. The hydration of the NTMP-treated surfaces occurs in three stages, namely the reverisble physisorption of water, the slow dissolution of NTMP followed by rapid hydration of the freshly exposed Al2O3 to AlOOH and further hydration of the surface to Al(OH)3. Five properties of an ideal inhibitor are identified. Author

N86-11252*# United Technologies Research Center, East Hartford, Conn.
FACTORS AFFECTING THE PROCESSING OF EPOXY FILM ADHESIVES **c27**
R. A. Pike *In* NASA. Langley Research Center Welding, Bonding and Fastening, 1984 Sep. 1985 p 397-418 refs (For primary document see N86-11227 02-23)
Avail: NTIS HC A21/MF A01 CSCL 11A

The increasing awareness that adhesive performance is controlled not only by the condition of the adherend surface but also the condition or state of the adhesive and the process parameters used during fabrication is expected to result in improved reliability, as well as bond performance. The critical process variables which have been found to control adhesive bond formation and ultimate bond strength in 250F and 350F curing epoxy adhesives are described in terms of fabrication parameters and adhesive characteristics. These include the heat-up rate and cure temperature during processing and the adhesive moisture content and age condition (degree of advancement). The diagnostic methods used to delineate the effects of these process variables on adhesive performance are illustrated. These are dielectric, thermomechanical (TMA) and dynamic mechanical (DMA) analyses. Correlation of test results with measured mechanical tensile lap shear strengths of bonded joints is presented and the results briefly discussed in terms of the additives and hardeners used in the adhesive systems. Author

N86-11253*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
RAPID ADHESIVE BONDING AND FIELD REPAIR OF AEROSPACE MATERIALS **c31**
Bland A. Stein *In its* Welding, Bonding and Fastening, 1984 Sep. 1985 p 419-438 ref (For primary document see N86-11227 02-23)
Avail: NTIS HC A21/MF A01 CSCL 13H

Adhesive bonding in the aerospace industry typically utilizes autoclaves or presses which have considerable thermal mass. As a consequence, the rates of heatup and cooldown of the bonded parts are limited and the total time and cost of the bonding process are often relatively high. Many of the adhesives themselves do not inherently require long processing times. Bonding could be performed rapidly if the heat was concentrated in the bond lines or at least in the adherends. Rapid Adhesive Bonding concepts are developed to utilize induction heating techniques to provide heat directly to the bond line and/or adherends without heating the entire structure, supports, and fixtures of a bonding assembly. Bonding times for specimens can be cut by a factor of 10 to 100 compared to standard press or autoclave bonding. The development of Rapid Adhesive Bonding for lap shear specimens (per ASTM D1002 and D3163), for aerospace panel or component bonding, and for field repair needs of metallic and advanced fiber reinforced polymeric-matrix composite structures is reviewed. Equipment and procedures are described for bonding and repairing thin sheets, simple geometries, and honeycomb core panels.
Author

N86-11254*# Naval Surface Weapons Center, White Oak, Md.
REDUCTION OF MOISTURE EFFECTS DURING THE CURE OF EPOXY ADHESIVES USED IN COMPOSITE REPAIR **c27**
Joseph M. Augl and George T. Sivy *In* NASA. Langley Research Center Welding, Bonding and Fastening, 1984 Sep. 1985 p 439-463 ref (For primary document see N86-11227 02-23)
Avail: NTIS HC A21/MF A01 CSCL 11A

The requirements for repair work on Naval aircraft composite wing skins that can be performed under depot conditions (or still worse, under field conditions) are quite restrictive. Equipment that can be used is rather limited as are the available repair space and time. The procedures must be simple enough so that they can be performed satisfactorily by personnel without special knowledge in composite materials technology. Repairs of small holes should not require more than perhaps a short predrying cycle (with heat guns) and a subsequent patch bonding using a heating blanket, held in place by applying a vacuum. However, it has been observed during simulated experimental repair work that the glue lines frequently show a high content of pores and bubbles which are attributed to evaporation of moisture during the curing cycle. (Of course, other volatile materials such as residual solvent would act similarly). The purpose of this paper is to give some detailed analysis of the problem of moisture transport as a function of repair conditions, and to discuss some preliminary work to reduce the effect of moisture by removing moisture chemically with carbodiimides before it reaches a critical level for bubble formations. Author

N86-11255*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
INITIAL INVESTIGATION OF CRYOGENIC WIND TUNNEL MODEL FILLER MATERIALS **c24**
George C. Firth *In its* Welding, Bonding and Fastening, 1984 Sep. 1985 p 465-481 refs (For primary document see N86-11227 02-23)
Avail: NTIS HC A21/MF A01 CSCL 11D

Filler materials are used for surface flaws, instrumentation grooves, and fastener holes in wind tunnel models. More stringent surface quality requirements and the more demanding test environment encountered by cryogenic wind tunnels eliminate filler materials such as polyester resins, plaster, and waxes used on conventional wind tunnel models. To provide a material data base for cryogenic models, various filler materials are investigated. Surface quality requirements and test temperature extremes require matching of coefficients of thermal expansion or interfacing

materials. Microstrain versus temperature curves are generated for several candidate filler materials for comparison with cryogenically acceptable materials. Matches have been achieved for aluminum alloys and austenitic steels. Simulated model surfaces are filled with candidate filler materials to determine finishing characteristics, adhesion and stability when subjected to cryogenic cycling. Filler material systems are identified which meet requirements for usage with aluminum model components. Author

N86-11256# Oak Ridge National Lab., Tenn.
DETERMINATION OF THE STEADY-STATE BEHAVIOR OF IMMOBILIZED (BETA)-GALACTOSIDASE UTILIZING AN INTEGRAL REACTOR SCHEME
T. C. Scott, C. G. Hill, Jr., and C. H. Amundson 1985 32 p refs Presented at the Symp. on Biotechnol. for Fuels and Chem., Gatlinburg, Tenn., 13 May 1985 Prepared in cooperation with Wisconsin Univ., Madison
(Contract DE-AC05-84OR-21400)
(DE85-012900; CONF-850513-1) Avail: NTIS HC A03/MF A01

Analysis of the steady-state behavior of immobilized (BETA)-galactosidase by integral reactor techniques has yielded a model which allows one to predict reactor performance under normal operating conditions. Values of the mechanistic rate constants for enzymatic hydrolysis of lactose were determined as a function of temperature by fitting the reactor model to experimental lactose conversion profiles. Use of this model along with the activity decay characteristics of the immobilized enzyme which have been presented in a previous publication could prove to be a useful tool in determining appropriate operating strategies for industrial applications of the immobilized enzyme catalyst. DOE

N86-11257# Cornell Univ., Ithaca, N.Y. Dept. of Plant Pathology.
IMPORTANCE OF PHYTOALEXIN TOLERANCE AND DETOXIFICATION FOR PATHOGENICITY Progress Report, Jun. 1983 - Jun. 1985
H. VanEtten and D. Matthews 1985 8 p refs
(Contract DE-AC02-83ER-13073)
(DE85-014759; DOE/ER-13073/T2) Avail: NTIS HC A02/MF A01

This study focuses on the biochemistry of phytoalexin detoxifying enzymes. Progress is reported on purification, substrate specificity, and the mechanism of several enzymes involved. Some aspects of the regulation of pisatin demethylase are studied since parallel genetic studies suggest its regulation is an important factor in the pathogenicity of Nectria haematococca. It is established that the detoxification of pisatin requires two components: NADPH-cytochrome c reductase and cytochrome P-450. The ability to separate and reconstitute these two components has allowed us to demonstrate that the reductase from a non-demethylating isolate of N. haematococca will support demethylating activity when combined with the cytochrome P-450 from a demethylating isolate. The finding that the critical genetic factor here is the cytochrome P-450 fraction reinforces the hypothesis that the multiple pda genes of this fungus encode different cytochrome P-450 isozymes. The evidence for monooxygenase catalyzed metabolism of maackiain suggests the existence of additional members of a phytoalexin detoxifying cytochrome P-450 family. DOE

N86-11272*# Boeing Aerospace Co., Seattle, Wash.
CHARACTERIZATION METHODOLOGY FOR PMR-15
A. B. Hunter *In* NASA. Lewis Research Center High Temp. Polymer Matrix Composites Sep. 1985 p 151-156 (For primary document see N86-11260 02-24)
(Contract NAS3-22523)
Avail: NTIS HC A18/MF A01 CSCL 07A

24 COMPOSITE MATERIALS

Includes laminates.

N86-11258 Michigan Univ., Ann Arbor.
A SIGNORINI MODEL OF BOLT FASTENED LAMINATED COMPOSITES Ph.D. Thesis
Ernest Ekeneme Nweke 1985 165 p
Avail: Univ. Microfilms Order No. DA8512479

A contact problem formulation of a failure strength predicting model of bolt fastened fiber reinforced laminated composites is presented. This model can handle any number of holes, it allows for gaps and friction on the pin-laminate interface. The contact stresses are also generated by this model. The model can also determine the slip/stick region as well as the slip that occurs of each node. It also gives a more realistic treatment of multiple hole cases without making apriori assumptions about the stress distribution on each pin. The procedure is as follows: first the stress distribution in the laminate is determined using an incremental signorini problem formulation; secondly a failure criterion (due to Yamada-Sun) is applied on a characteristics curve (due to Chang). A finite element computer code (COMRAD) was developed to implement the procedure and calculate the failure load and mode for the laminate. The results from this model were compared to experimental and theoretical results, and was found to do better in load prediction. Dissert. Abstr.

N86-11259 Illinois Univ., Urbana-Champaign.
TENSILE FATIGUE DAMAGE AND DEGRADATION OF RANDOM SHORT-FIBER SWC COMPOSITE
Edwin Siu-Man Chim 1985 169 p
Avail: Univ. Microfilms Order No. DA8511596

In the study of homogeneous damage, experiments were conducted to examine fundamental mechanisms and characteristics of fatigue damage and its evolution. The statistical nature of microcracks was evaluated by the introduction of damage distribution functions. Results showed that the cumulative distribution and density of microcrack length followed the form of a three-parameter Weibull function. In the nonhomogeneous damage study, residual tensile strength and fracture toughness were determined experimentally. Both of these quantities were found to decrease gradually with fatigue cycles. The results also revealed that the notch still dominated the fracture behavior in the damaged composite and that fracture mechanics concepts and analysis were applicable. A distributed damage model and a ligament model to study the mechanics of fatigue crack growth were examined. The distributed damage model which contains several salient features unique to the SMC-R50 composite is too complicated for analysis while the ligament model leads to results which fit the experimental data well, but the mechanics associated with the model is questionable. Dissert. Abstr.

N86-11260*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HIGH TEMPERATURE POLYMER MATRIX COMPOSITES
Washington Sep. 1985 409 p refs Conf. held in Cleveland, Ohio, 16-18 Mar. 1983
(NASA-CP-2385; E-2425; NAS 1.55:2385) Avail: NTIS HC A18/MF A01 CSCL 11D

These are the proceedings of the High Temperature Polymer Matrix Composites Conference held at the NASA Lewis Research Center on March 16 to 18, 1983. The purpose of the conference is to provide scientists and engineers working in the field of high temperature polymer matrix composites an opportunity to review, exchange, and assess the latest developments in this rapidly expanding area of materials technology. Technical papers are presented in the following areas: (1) matrix development; (2) adhesive development; (3) characterization; (4) environmental effects; and (5) applications. For individual titles, see N86-11261 through N86-11291.

N86-11261*# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio. Materials Lab.
ACETYLENE TERMINATED MATRIX RESINS
I. J. Goldfarb, Y. C. Lee, F. E. Arnold, and T. E. Helminiak *In* NASA. Lewis Research Center High Temp. Polymer Matrix

Composites Sep. 1985 p 1-9 refs (For primary document see N86-11260 02-24)
Avail: NTIS HC A18/MF A01 CSCL 11D

The synthesis of resins with terminal acetylene groups has provided a promising technology to yield high performance structural materials. Because these resins cure through an addition reaction, no volatile by-products are produced during the processing. The cured products have high thermal stability and good properties retention after exposure to humidity. Resins with a wide variety of different chemical structures between the terminal acetylene groups are synthesized and their mechanical properties studied. The ability of the acetylene cured polymers to give good mechanical properties is demonstrated by the resins with quinoxaline structures. Processibility of these resins can be manipulated by varying the chain length between the acetylene groups or by blending in different amounts of reactive deluents. Processing conditions similar to the state-of-the-art epoxy can be attained by using backbone structures like ether-sulfone or bis-phenol-A. The wide range of mechanical properties and processing conditions attainable by this class of resins should allow them to be used in a wide variety of applications. Author

N86-11262*# Hughes Aircraft Co., Culver City, Calif. Technology Support Div.

AN IMPROVED PROCESSIBLE ACETYLENE-TERMINATED POLYIMIDE FOR COMPOSITES

Abraham L. Landis and Arthur B. Naselow *In* NASA. Lewis Research Center High Temp. Polymer Matrix Composites Sep. 1985 p 11-22 refs (For primary document see N86-11260 02-24)
Avail: NTIS HC A18/MF A01 CSCL 11D

The newest member of a family of thermosetting acetylene-substituted polyimide oligomers is HR600P. This oligomer is the isoimide version of the oligomer known as HR600P and Thermid 600. Although both types of material yield the same heat resistant end products after cure, HR600P has much superior processing characteristics. This attributed to its lower melting temperature (160 + or - 10 C, 320 + or - 20 F) in contrast to 202 C (396 F) for Thermid MC-600, its longer gel time at its processing temperature (16 to 30 minutes bvs 3 minutes), and its excellent solubility in low boiling solvents such as tetrahydrofuran, glymes, or 4:1 methyl ethyl ketone/toluene mixtures. These advantages provide more acceptable coating and impregnation procedures, allow for more complete removal at lower temperatures, provide a longer pot life or working time, and allow composite structure fabrication in conventional autoclaves used for epoxy composite curing. The excellent processing characteristics of HR600P allow its use in large area laminated structures, structural composites, and molding compositions. Author

N86-11263*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PMR POLYIMIDES FROM SOLUTIONS CONTAINING MIXED ENDCAPS c27

Peter Delvigs *In its* High Temp. Polymer Matrix Composites Sep. 1985 p 23-34 refs (For primary document see N86-11260 02-24)
Avail: NTIS HC A18/MF A01 CSCL 11B

Previous studies have shown that partial substitution of p-aminostyrene (PAS) for the monomethylester of endo-5-norbornene-2, 3-dicarboxylic acid (NE) lowered the cure temperature of PMR polyimides from 316 to 260 C, but the modified PMR polyimides required higher compression-molding pressures than state-of-the-art PMR-15. In this study PMR polyimides are prepared employing three encaps: NE, PAS, and endo-N-phenyl-5-norbornene-2,3-dicarboximide (PN). The effect of PN addition on the processing characteristics and glass transition temperatures of graphite fiber-reinforced PMR composites is studied. The room temperature and short-time 316 C mechanical properties of the composites are determined. The weight loss and mechanical property retention characteristics of the composites after exposure in air at 316 C are also determined. Author

N86-11264*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

MATRIX RESIN DEVELOPMENT AT NASA LANGLEY RESEARCH CENTER

Terry L. St.Clair *In* NASA. Lewis Research Center High Temp. Polymer Matrix Composites Sep. 1985 p 35-53 refs (For primary document see N86-11260 02-24)
Avail: NTIS HC A18/MF A01 CSCL 11D

The polymer program at NASA Langley Research Center involves exploratory studies in polymer science. These include the synthesis of novel polymers and their characterization. Polymer synthesis programs involve the development of novel thermoplastics, pseudothermoplastics, and thermosets. Recent investigations have led to the development of more easily processable polyimides, solvent-resistant polysulfones and polyphenylquinoxalines, and tougher high and intermediate-temperature polymers. Characterization efforts have included high-pressure liquid chromatography methodology, the development of toughness tests for fiber-reinforced composites, a study of electrical properties of metal-ion-filled polyimides, and a study of the mutagenicity of aromatic diamines. Also the mechanism of cure/degradation of experimental polymers has been studied by rheology, mechanical behavior, separation techniques and spectroscopy. Some of these programs have involved the degradation crosslinking of alkyl-containing polyimides, the separation and identification of crosslinked phenylquinoxalines, the rheological behavior of hot-melt polyimides, and the elucidation of the cure of norbornene endcapped imides. Author

N86-11265*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

BISMALEIMIDES AND RELATED MALEIMIDO POLYMERS AS MATRIX RESINS c27

John A. Parker, Demitrius A. Kourtides, and George M. Fohlen *In* NASA. Lewis Research Center High Temp. Polymer Matrix Composites Sep. 1985 p 55-77 refs (For primary document see N86-11260 02-24)
Avail: NTIS HC A18/MF A01 CSCL 11B

Significant processing and property improvements can be achieved by copolymerization of state-of-the-art bisimides with various vinyl stilbazole derivatives to give both fire resistance and high-temperature properties from hot-melt compositions. Significant improvement in mechanical properties is achieved through these modifications, which may make these new matrix resins ideal candidates for fireworthy secondary graphite composite structures. Phosphorous modifications of maleimido polymers through phosphonate structure and tricyclophosphazene derivatives provide families of new matrix resins for short-time applications in severe thermo-oxidative environments. With further research these may provide matrix resins for long-term thermo-oxidative stability of advanced composites at temperatures up to 400 to 500 C. Author

N86-11266*# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Chemistry.

THE SYNTHESIS, CHARACTERIZATION AND THERMAL CHEMISTRY OF MODIFIED NORBORNENYL PMR ENDCAPS c27

Chaim N. Sukenik, William M. Ritchey, Vinay Malhotra, and Uday Varde *In* NASA. Lewis Research Center High Temp. Polymer Matrix Composites Sep. 1985 p 79-90 refs (For primary document see N86-11260 02-24)
(Grant NAG3-163)
Avail: NTIS HC A18/MF A01 CSCL 11B

As part of a program to further the understanding of the polymerization of Nadic-Endcapped PMR systems, a series of model Norbornenyl-Imides has been synthesized and their thermal behavior explored. Their syntheses and characterizations as well as their rearrangement and polymerization chemistry are described. Monomer isomerization at temperatures as low as 125 C and oligomer formation at somewhat higher temperatures are observed. Approximate relative rates for competing isomerization pathways are established and some information is obtained about the details of oligomer formation. The relationship of this data to current PMR systems is briefly discussed. Author

N86-11267*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ALL-AROMATIC BIPHENYLENE END-CAPPED POLYQUINOLINE AND POLYIMIDE MATRIX RESINS **c27**
John P. Droske (Colorado State Univ.), John K. Stille (Colorado State Univ.), and William B. Alston *In its* High Temp. Polymer Matrix Composites Sep. 1985 p 91-95 refs (For primary document see N86-11260 02-24)
Avail: NTIS HC A18/MF A01 CSCL 11B

Biphenylene end-capped polyquinoline and polyimide resins afford low void content graphite-reinforced composites with good initial properties. However, with both resins, rapid degradation occurs during oxidative isothermal aging at elevated temperatures. The degradation is not observed during isothermal aging under a nitrogen atmosphere which suggests that the biphenylene end-cap (or the resulting crosslink/chain extension structures) is not particularly thermooxidatively stable. The nature of the thermooxidative instability is currently under investigation. Author

N86-11268*# Boeing Aerospace Co., Seattle, Wash.
EVALUATION OF A HIGH TEMPERATURE ADHESIVE FOR FABRICATING GRAPHITE/PMR-15 POLYIMIDE STRUCTURES **c27**
S. G. Hill and J. B. Cushman *In* NASA. Lewis Research Center High Temp. Polymer Matrix Composites Sep. 1985 p 97-108 refs (For primary document see N86-11260 02-24)
Avail: NTIS HC A18/MF A01 CSCL 11A

Tests are conducted to measure shear strength, shear modulus and flatwise tensile strength of the A7F (amide-imide modified LARC-13) adhesive system. An investigation is also conducted to determine the effect of geometric material parameters, and elevated temperature on the static strength of standard joints. Single-lap and double-lap composite joints, and single, double and step lap composite to metal joints are characterized. A series of advanced joints consisting of preformed adherends, adherends with scalloped edges and joints with hybrid interface plies are tested and compared to baseline single and double-lap designs. Author

N86-11269*# Dexter Corp., Pittsburg, Calif. Hyson Div.
NEW PROCESSABLE MODIFIED POLYIMIDE RESINS FOR ADHESIVE AND MATRIX APPLICATIONS **c27**
David Landman *In* NASA. Lewis Research Center High Temp. Polymer Matrix Composites Sep. 1985 p 109-123 refs (For primary document see N86-11260 02-24)
Avail: NTIS HC A18/MF A01 CSCL 11B

A broad product line of bismaleimide modified epoxy adhesives which are cured by conventional addition curing methods is described. These products fill a market need for 232 C (450 F) service adhesives which are cured in a manner similar to conventional 177 C (350 F) epoxy adhesives. The products described include film adhesives, pastes, and a primer. Subsequent development work has resulted in a new bismaleimide modified epoxy resin which uses a unique addition curing mechanism. This has resulted in products with improved thermomechanical properties compared to conventional bismaleimide epoxy resins. A film adhesive, paste, and matrix resin for composites using this new technology are described. In all cases, the products developed are heat cured by using typical epoxy cure cycles i.e., 1 hour at 177 C (350 F) followed by 2 hours postcure at 246 C (475 F).
Author

N86-11270*# American Cyanamid Co., Stamford, Conn. Chemical Research Div.
RECENT DEVELOPMENTS IN POLYIMIDE AND BISMALEIMIDE ADHESIVES **c27**
Robert E. Politi *In* NASA. Lewis Research Center High Temp. Polymer Matrix Composites Sep. 1985 p 125-136 (For primary document see N86-11260 02-24)
Avail: NTIS HC A18/MF A01 CSCL 11B

Research on high temperature resin systems has intensified. In the Aerospace Industry, the motivation for this increased activity has been to replace heat resistant alloys of aluminum, stainless steel and titanium by lighter weight glass and carbon fiber reinforced composites. Applications for these structures include: (1) engine nacelles involving long time exposure (thousands of hours) to temperatures in the 150 to 300 C range, (2) supersonic military aircraft involving moderately long exposure (hundreds of hours) to temperatures of 150 to 200 C, and (3) missile applications involving only brief exposure (seconds or minutes) to temperatures up to 500 C and above. Because of fatigue considerations, whenever possible, it is preferable to bond rather than mechanically fasten composite structures. For this reason, the increased usage of high temperature resin matrix systems for composites has necessitated the devlopment of compatible and equally heat stable adhesive systems. The performance of high temperature epoxy, epoxy phenolic and condensation polyimide adhesives is reviewed. This is followed by a discussion of three recently developed types of adhesives: (1) condensation reaction polyimides having improved processing characteristics; (2) addition reaction polyimides; and (3) bismaleimides. Author

N86-11271*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CHEMICAL CONTROL OF RATE AND ONSET TEMPERATURE OF NADIMIDE POLYMERIZATION **c27**
Richard W. Lauver *In its* High Temp. Polymer Matrix Composites Sep. 1985 p 137-149 refs (For primary document see N86-11260 02-24)
Avail: NTIS HC A18/MF A01 CSCL 11B

The chemistry of norbornenyl capped imide compounds (nadimides) is briefly reviewed with emphasis on the contribution of Diels-Alder reversion in controlling the rate and onset of the thermal polymerization reaction. Control of onset temperature of the cure exotherm by adjusting the concentration of maleimide is demonstrated using selected model compounds. The effects of nitrophenyl compounds as free radical retarders on nadimide reactivity are discussed. A simple copolymerization model is proposed for the overall nadimide cure reaction. An approximate numerical analysis is carried out to demonstrate the ability of the model to simulate the trends observed for both maleimide and nitrophenyl additions. Author

N86-11272*# Boeing Aerospace Co., Seattle, Wash.
CHARACTERIZATION METHODOLOGY FOR PMR-15 **c23**
A. B. Hunter *In* NASA. Lewis Research Center High Temp. Polymer Matrix Composites Sep. 1985 p 151-156 (For primary document see N86-11260 02-24)
(Contract NAS3-22523)
Avail: NTIS HC A18/MF A01 CSCL 07A

Characterization of model compounds, monomers, resin solutions and cure cycles of PMR-15 polyimide are performed. Successful separation of various reaction products is also accomplished by liquid chromatography. The PMR-15 cure analysis is performed by fourier transform spectroscopy and gas chromatograph - mass spectrometry. Characterization receiving inspection tests for Quality Control are recommended. Author

N86-11273*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
CHARACTERIZATION OF POLYIMIDE MATRIX RESINS AND PREPREGS
M. G. Maximovich and R. M. Galeos *In* NASA. Lewis Research Center High Temp. Polymer Matrix Composites Sep. 1985 p 157-170 refs (For primary document see N86-11260 02-24)
Avail: NTIS HC A18/MF A01 CSCL 11D

Graphite/polyimide composite materials are attractive candidates for a wide range of aerospace applications. They have many of the virtues of graphite/epoxies, i.e., high specific strengths and stiffness, and also outstanding thermal/oxidative stability. Yet they are not widely used in the aerospace industry due to problems of procesability. By their nature, modern addition polyimide (PI) resins and prepregs are more complex than epoxies; the key to processing lies in characterizing and understanding the materials. Chemical and rheological characterizations are carried out on several addition polyimide resins and graphite reinforced prepregs, including those based on PMR-15, LARC 160 (AP 22), LARC 160 (Curithane 103) and V378A. The use of a high range torque transducer with a

Rheometrics mechanical spectrometer allows rheological data to be generated on prepreg materials as well as neat resins. The use of prepreg samples instead of neat resins eliminates the need for preimidization of the samples and the data correlates well with processing behavior found in the shop. Rheological characterization of the resins and prepregs finds significant differences not readily detected by conventional chemical characterization techniques. Author

N86-11274*# Rockwell International Science Center, Thousand Oaks, Calif.

QUALITY ASSURANCE PROCEDURES FOR V378A MATRIX RESIN

Charles L. Hamermesh and Paul J. Dynes *In* NASA. Lewis Research Center High Temp. Polymer Matrix Composites Sep. 1985 p 171-185 refs Sponsored by AFWAL (For primary document see N86-11260 02-24)

Avail: NTIS HC A18/MF A01 CSCL 11D

A characterization methodology has been developed on which to base quality assurance procedures for U.S. Polymeric V378A bismaleimide matrix resin. Chemical composition is established by partition reverse phase and size exclusion liquid chromatography. Cure rheology behavior is quantitatively characterized by dynamic viscoelastic analysis using the parallel plate technique. The overall cure process is characterized by differential scanning calorimetry. The sensitivity of the procedures is evaluated by studying the effects of ambient out time on the chemical end behaviorial properties of the resin. Author

N86-11275*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

REPLACEMENT OF MDA WITH MORE OXIDATIVELY STABLE DIAMINES IN PMR-POLYIMIDES c27

William B. Alston *In its* High Temp. Polymer Matrix Composites Sep. 1985 p 187-205 refs (For primary document see N86-11260 02-24)

Avail: NTIS HC A18/MF A01 CSCL 11B

Studies are performed to investigate the effect of substituting 4,4'-oxydianiline and 1,1-bis(4-aminophenyl)-1-phenyl-2,2,2-trifluoroethane for the 4,4'-methylenedianiline in PMR polyimide matrix resin. Graphite fiber reinforced composites are fabricated from unsized Celion 6000 and PMR-polyimide matrix resins having formulated molecular weights in the range of 1500 to 2400. The composite processing characteristics are investigated and the initial room temperature and 316 C (600 F) composite mechanical properties are determined. Comparative 316 C composite weight losses and 316 C mechanical properties retention after prolonged 316 C air exposure are also determined. Author

N86-11276*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PROPERTIES OF AUTOCLAVED Gr/PI COMPOSITES MADE FROM IMPROVED TACK PMR-15 PREPREG

Raymond D. Vannucci *In its* High Temp. Polymer Matrix Composites Sep. 1985 p 207-215 refs (For primary document see N86-11260 02-24)

Avail: NTIS HC A18/MF A01 CSCL 11D

Autoclave processing studies were conducted, using improved tack PMR-15 prepreg, to determine the effect of tack enhancing PMR resin modifications on composite processability and mechanical properties. Improved tack graphite fiber reinforced PMR-15 prepregs were prepared and exposed to ambient conditions for various times and then autoclave molded into composites. Composite specimens were prepared and tested for flexural and interlaminar shear strengths at room temperature and 316 C. The retention of flexural and interlaminar shear strength as a function of exposure in air at 316 C was also determined. The results show that the modified PMR resin solutions provide prepreg with improved tack and drape retention characteristics without adversely affecting processability or mechanical properties of autoclave molded graphite fiber reinforced PMR-15 composites. Author

N86-11277*# United Technologies Research Center, East Hartford, Conn.

THERMO-OXIDATIVE STABILITY OF GRAPHITE FIBER/PMR-15 POLYIMIDE COMPOSITES AT 350 DEG C

Daniel A. Scola *In* NASA. Lewis Research Center High Temp. Polymer Matrix Composites Sep. 1985 p 217-242 refs (For primary document see N86-11260 02-24)

Avail: NTIS HC A18/MF A01 CSCL 11D

A series of graphite fiber/PMR-15 polyimide composites were subjected to isothermal aging at 350 C in flowing air (100 cc/min and 1000 cc/min) over a 520 hr time period. The graphite fibers were analyzed by ISS/SIMS techniques before composite fabrication. Fibers exposed at the surface of the composite due to the isothermal aging process were also analyzed by the ISS/SIMS method. Component and composite weight less studies were also conducted for similarly exposed materials. Optical micrograph investigations of composites to follow the progress of the thermo-oxidative process were also conducted. Flexural and interlaminar shear strengths of the imaged and aged composites were measured. The relationship of component and composite properties as they relate to the thermo-oxidative behavior of the materials was discussed. Author

N86-11278*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

RHEOLOGICAL, PROCESSING, AND 371 DEG C MECHANICAL PROPERTIES OF CELION 6000/N-PHENYLNADIMIDE MODIFIED PMR COMPOSITES

Ruth H. Pater *In its* High Temp. Polymer Matrix Composites Sep. 1985 p 243-256 refs (For primary document see N86-11260 02-24)

Avail: NTIS HC A18/MF A01 CSCL 11D

The rheology, processing, and chemistry of newly developed N-phenylnadimide modified PMR (PMR-PN) polyimide resins are reviewed. The 371 C performance of their composites reinforced with Celion 6000 graphite fibers is also reviewed, along with the state of the art Celion 6000/PMR-15 composite. The effects of the 371 C exposure in air for up to 300 hr on the composite glass transition temperature, weight loss characteristics, and dimensional stability are presented. The changes in the composite 371 C interlaminar shear and flexural properties are also presented. In addition, composite interfacial degradation at a function of exposure time at 371 C was followed by scanning electron microscopy. The results suggest that the composite materials can be used at 371 C for at least 100 hr. Author

N86-11279*# Raytheon Co., Bedford, Mass. Missile Systems Div.

HIGH TEMPERATURE, SHORT TERM TENSILE STRENGTH OF C6000/PMR-15 COMPOSITES

P. R. DiGiovanni and D. Paterson *In* NASA. Lewis Research Center High Temp. Polymer Matrix Composites Sep. 1985 p 257-269 refs (For primary document see N86-11260 02-24)

Avail: NTIS HC A18/MF A01 CSCL 11D

Tensile tests were conducted on 0 unidirectionally reinforced Celion 6000 graphite fibers in PMR-15 polyimide matrix. Tensile strengths for coupons subjected to short and long term uniform temperatures were obtained. Thick coupons, heated on one side to produce significant transient through thickness temperature gradients, were tested and compared to the strength of specimens with uniform temperature distributions. All coupons were radiantly heated and reached maximum test temperatures within 15 sec. Tensile loads were applied to the coupons after 15 sec of elevated temperature exposure. Loading rates were selected so that specimen failures occurred within a maximum of 45 sec after reaching the test temperature. Results indicate that significant tensile strength remains beyond the material post cure temperature. Author

N86-11280*# TRW, Inc., Redondo Beach, Calif. Energy Development Group.

POLYIMIDE MATRIX RESINS FOR UP TO 700 DEG F SERVICE

R. J. Jones, G. E. Chang, S. H. Powell, and H. E. Green *In*

NASA. Lewis Research Center High Temp. Polymer Matrix Composites Sep. 1985 p 271-285 refs (For primary document see N86-11260 02-24)
Avail: NTIS HC A18/MF A01 CSCL 11D

TRW is in the process of data accumulation that strongly indicates that incorporation of the perfluorsisopropylidene linkage in molecular structures other than those employed in DU Pont's NR-150B polyimides likewise yield polymers demonstrating extremely high thermo-oxidative stability. Polyimide synthetic and characterization studies conducted to date on new polymers incorporating the perfluoroisopropylidene linkage are presented and discussed. G.L.C.

N86-11281*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SURFACE PROTECTION OF GRAPHITE FABRIC/PMR-15 COMPOSITES SUBJECTED TO THERMAL OXIDATION
M. P. Hanson and T. T. Serafini *In its* High Temp. Polymer Matrix Composites Sep. 1985 p 287-297 refs (For primary document see N86-11260 02-24)
Avail: NTIS HC A18/MF A01 CSCL 11D

Graphite fabric/PMR-15 laminates develop matrix cracks during long-term exposure in air at temperatures in the range of 500 to 600 F. This study was performed to demonstrate the effectiveness of incorporating graphite mat surface plies as a means of reducing the developing of matrix cracks. Celion 3000 graphite fabric/PMR-15 laminates were fabricated with graphite or graphite mat/325-mesh boron powder surface plies. Laminates without mat surface plies were also fabricated for control purposes. Composite flexural strength, flexural modulus, and interlaminar shear strength were determined at 288 C before and after long-term exposure (up to 1500 hr) in air at 316 C. The results of this study showed that the incorporation of graphite mat surface plies reduces matrix cracking and improves the elevated temperature mechanical property retention characteristics of the composites. Author

N86-11282*# Naval Surface Weapons Center, White Oak, Md.
MICROSCOPIC EVALUATION OF A POLYIMIDE (PMR-15)-GRAPHITE COMPOSITE
Jeffry J. Fedderly and Joseph M. Augl *In* NASA. Lewis Research Center High Temp. Polymer Matrix Composites Sep. 1985 p 299-314 (For primary document see N86-11260 02-24)
Avail: NTIS HC A18/MF A01 CSCL 11D

An effort to evaluate the high temperature performance of a polyimide (PMR-15)-graphite composite which consists of several plies of woven strands of carbon fibers was undertaken. The longterm effect of high temperature on the dry material was studied by exposing polished test specimens of 473 F in a oven for nearly 400 hours. Periodically the specimens were removed and observed microscopically. Gradually surface cracks began to appear and the number of cracks increased over time. At the conclusion of the exposure the specimens were graudually ground down and observed in order to determine the depth of the cracks into the interior of the material. This procedure was repeated at an exposure temperature of 550 F. G.L.C.

N86-11283*# General Dynamics/Convair, San Diego, Calif.
EFFECTS OF REAL-TIME THERMAL AGING ON GRAPHITE/POLYIMIDE COMPOSITES
J. F. Haskins and J. R. Kerr *In* NASA. Lewis Research Center High Temp. Polymer Matrix Composites Sep. 1985 p 315-327 refs (For primary document see N86-11260 02-24)
(Contract NAS1-12308)
Avail: NTIS HC A18/MF A01 CSCL 11D

As part of a program to evaluate high-temperature advanced composites for use on supersonic cruise transport aircraft, two graphite/polyimide composites have been aged at elevated temperatures for times up to 5.7 years. Work on the first, HT-S/710 graphite/polyimide, was started in 1974. Evaluation of the second polyimide, Celion 6000/LARC-160, began in 1980. Baseline properties are presented, including unnotched and notched tensile data as a function of temperature, compression, flexure, shear, and constant-amplitude fatigue data at R = 0.1 and R = -1. Tensile specimens were aged in ovens where pressure and aging temperatures were controlled for various times up to and including 50,000 hours. Changes in tensile strength were determined and plotted as a function of aging time. The HT-S/710 composite aged at 450 F and 550 F if compared to the Celion 6000/LARC-160 composite aged at 350 F and 450 F. After tensile testing, many of the thermal aging specimens were examined using a scanning electron microscope. Results of these studies are presented, and changes in properties and degradation mechanisms during high-temperature aging are discussed and illustrated using metallographic techniques. Author

N86-11284*# Boeing Commercial Airplane Co., Seattle, Wash.
ENVIRONMENTAL STABILITY GRAPHITE/PMR-15 COMPOSITES
Clyde H. Sheppard and Doug McLaren *In* NASA. Lewis Research Center High Temp. Polymer Matrix Composites Sep. 1985 p 329-334 refs (For primary document see N86-11260 02-24)
Avail: NTIS HC A18/MF A01 CSCL 11D

During the past few years the Boeing Company was screening graphite composites for use in hot areas of engine nacelle structure. Structural and thermal analyses have shown that there is the potential for a 25 to 30 percent weight savings by using a graphite polyimide (Gr/PI) composite material in this type of structure. Work conducted on the NASA CASTS program (Composites for Advanced Space Transportation Systems) amply demonstrated the capability of Graphite/PMR-15 for short term service (125 hours) at temperatures up to 589 K (600 F). In addition, the CASTS program demonstrated that large structures could be fabricated using Gr/PMR-15. In commercial applications, however, the requirement exists for long term service capability (tens of thousands of hours) at temperatures ranging upwards from 449 K (350 F). The results of Graphite/PMR-15 materials characterization efforts conducted at Boeing are presented with emphasis on materials properties after isothermal aging at temperatures of 449 K (350 F) and above. Author

N86-11285*# Boeing Commercial Airplane Co., Seattle, Wash.
DEVELOPMENT OF DESIGN DATA FOR PROPULSION PMR-15 COMPOSITES
J. Postlewaite and Doug McLaren *In* NASA. Lewis Research Center High Temp. Polymer Matrix Composites Sep. 1985 p 335-338 (For primary document see N86-11260 02-24)
Avail: NTIS HC A18/MF A01 CSCL 11D

The continuing develoment of PMR-15 composite materials and their associated design properties is pacing the implementation of this technology on commercial aircraft. The guidelines that the FAA has issued regarding the certification of advanced composite structures are very significant with respect to future PMR-15 research and development activities. The FAA has issued an advisory circular dated 1-5-83 concerning guidelines for composite aircraft structures. Of particular significance to PMR-15 technology development is the reliance on combined environmental exposure and component testing, coupled with the stipulation that reliance on previous experience be limited to where common structures and materials have been used for a similar function. Critical environmental exposures for commercial propulsion structures include 50,000 cycle service life, exposure to skydrol, moisture and other fluids, and nacelle fire conditions. G.L.C.

N86-11286*# Grumman Aerospace Corp., Bethpage, N.Y.
POLYIMIDE COMPOSITES: APPLICATION HISTORIES
Leonard M. Poveromo *In* NASA. Lewis Research Center High Temp. Polymer Matrix Composites Sep. 1985 p 339-358 refs (For primary document see N86-11260 02-24)
Avail: NTIS HC A18/MF A01 CSCL 11D

Advanced composite hardware exposed to thermal environments above 127 C (260 F) must be fabricated from materials having resin matrices whose thermal/moisture resistance is superior to that of conventional epoxy-matrix systems. A family of polyimide resins has evolved in the last 10 years that exhibits the thermal-oxidative stability required for high-temperature technology applications. The weight and structural benefits for organic-

matrix composites can now be extended by designers and materials engineers to include structures exposed to 316 F (600 F). Polyimide composite materials are now commercially available that can replace metallic or epoxy composite structures in a wide range of aerospace applications. Author

N86-11287*# HITCO, Gardena, Calif. Materials Div.
V-378A: A MODIFIED BISMALEIMIDE FOR ADVANCED COMPOSITES
S. W. Street *In* NASA. Lewis Research Center High Temp. Polymer Matrix Composites Sep. 1985 p 359-378 (For primary document see N86-11260 02-24)
Avail: NTIS HC A18/MF A01 CSCL 11D

Addition polyimides cure with no evolution of gaseous by-products at relatively low temperatures and may be cured at low pressures to yield composites with excellent hot-wet strength retention. These properaties have made them excellent candidates as matrix resins for advanced composites. However, commercially available bismaleimides are solids and difficult to handle in preimpregnated form. V-378A is an addition polyimide composed of a mixture of bismaleimides and other reactive ingredients formulated to provide good prepreg properties and handling, facile cure and excellent composite mechanical properties. Several curing mechanisms are utilized to provide the characteristics exhibited by V-378A. Part of the mechanism is free radial and takes place at ambient temperature and above. Other mechanisms are principally Diels-Alder in nature. V-378A prepregs are tacky at ambient temperature, but do not have long tacky outlife similar to some epoxies. V-378A yields composites which exhibit hot-wet strength retention which is superior to that provided by epoxy resin systems. G.L.C.

N86-11288*# Tribon Bearing Co., Cleveland, Ohio.
TRANSFER MOLDING OF PMR-15 POLYIMIDE RESIN **c27**
J. P. Reardon, D. W. Moyer, and B. E. Nowak *In* NASA. Lewis Research Center High Temp. Polymer Matrix Composites Sep. 1985 p 379-392 refs (For primary document see N86-11260 02-24)
Avail: NTIS HC A18/MF A01 CSCL 11B

Transfer molding is an economically viable method of producing small shapes of PMR-15 polyimide. It is shown that with regard to flexural, compressive, and tribological properties transfer-molded PMR-15 polyimide is essentially equivalent to PMR-15 polyimide produced by the more common method of compression molding. Minor variations in anisotropy are predictable effects of molding design and secondary finishing operations. Author

N86-11289*# Boeing Commercial Airplane Co., Seattle, Wash.
APPLICATION OF Gr/PMR-15 TO COMMERCIAL AIRCRAFT
J. Postlewaite, K. Porter, and Doug McLaren *In* NASA. Lewis Research Center High Temp. Polymer Matrix Composites Sep. 1985 p 393-400 (For primary document see N86-11260 02-24)
Avail: NTIS HC A18/MF A01 CSCL 11D

Following from early experience with polyimides on the SST program and Shuttle aft flap studies the Boeing Company is now working on collaborative programs with its principal nacelle suppliers to pursue the development of Gr/PMR-15 nacelle components. Two programs are currently in effect. The first program is directed specifically towards the flight test and service evaluation at the earliest possible date of a 747 nacelle core cowl structure. The second program seeks to firmly establish the producibility and cost of a 757 thrust reverser C duct in a production environment. The near term objectives of these programs include: (1) the comparison of estimated cost and weight of Gr/PMR-15 versus metal structure, (2) the engine test of representative composite structure, (3) the preliminary design and analysis of the C duct structure, and (4) the preparation of cost data and time schedules for the development and producibility program. In addition to powerplant structure, the propulsion ducting system has shown to be a strong candidate for Gr/PMR-15 application. Currently, the Boeing 747 Organization is evaluating the use of PMR-15 matrix composites to replace nearly 800 lbs of titanium ducting per airplane. Author

N86-11290*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Business Group.
FABRICATION PROCESS OF A HIGH TEMPERATURE POLYMER MATRIX ENGINE DUCT
R. D. Pratt and A. J. Wilson *In* NASA. Lewis Research Center High Temp. Polymer Matrix Composites Sep. 1985 p 401-407 (For primary document see N86-11260 02-24)
Avail: NTIS HC A18/MF A01 CSCL 11D

The process that was used in the molding of an advanced composite outer by-pass duct planned for the F404 engine is discussed. This duct was developed as a potential replacement for the existing titanium duct in order to reduce both the weight and cost of the duct. The composite duct is now going into the manufacturing technology portion of the program. The duct is fabricated using graphite cloth impregnated with the PMR-15 matrix system. G.L.C.

N86-11291*# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.
CURRENT AND FUTURE ENGINE APPLICATIONS OF Gr/PI COMPOSITES
P. J. Cavano and T. E. Schmid *In* NASA. Lewis Research Center High Temp. Polymer Matrix Composites Sep. 1985 p 409-416 (For primary document see N86-11260 02-24)
Avail: NTIS HC A18/MF A01 CSCL 11D

The application of organic matrix composites to gas turbine engine components has been the subject of numerous government and company funded programs since the 1960's. The possibility of significant weight reductions, performance improvements and lower component costs have made the organic matrix composites extremely attractive to aircraft engine designers. Very little of this potential was incorporated into production engines over the years even though a significant number of components were designed, fabricated and tested. Some of the reasons behind the slow rate of incorporation include the following: (1) criticality; (2) engine operating temperature; (3) small component size; (4) small production volume; (5) high production cost; and (6) interfacing with metal parts. G.L.C.

N86-11292*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A PROGRAM TO DETERMINE THE EFFECT OF LOW-VELOCITY IMPACTS ON THE STRENGTH OF THE FILAMENT-WOUND ROCKET MOTOR CASE FOR THE SPACE SHUTTLE
C. C. Poe, Jr., W. Illg, and D. P. Garber (PRC Kentron, Inc., Hampton, Va.) Sep. 1985 82 p refs
(NASA-TM-87588; NAS 1.15:87588) Avail: NTIS HC a05/MF A01 CSCL 11D

Graphite/epoxy filament-wound cases (FWC) are being developed for the solid rocket motors of the space shuttle. The FWC cases will be used on certain missions that require a structural mass less than that of the existing steel cases. The 12-foot-diameter FWC cases are wound with AS4W graphite fiber impregnated with an epoxy resin and are about 1.4 inches or more thick. Graphite-epoxy composite laminates, unlike metals, can be damaged relatively easily by low-velocity impacts of objects like dropped tools. The impact tests are conducted on a representative filament-wound laminate. The specimens are supported to simulate a fueled (stiff) and an empty (flexible) case. Impactors of various kinetic energy, mass, and shape are used. The conditions that give minimum visual evidence of damage are emphasized. The capability to characterize impact damage with various nondestructive evaluation (NDE) methods is also evaluated. After impact, the specimens are loaded uniaxially in tension to determine residual strengths. The residual strengths of impacted specimens are compared with fracture mechanics predictions based on a semi-elliptic surface cut of the same size as the impact damage. Author

N86-11293*# Rensselaer Polytechnic Inst., Troy, N. Y.
COMPOSITE STRUCTURAL MATERIALS Semiannual Progress Report, 30 Sep. 1984 - 30 Apr. 1985
Robert G. Loewy and Stephen E. Wiberley Aug. 1985 78 p refs Sponsored in cooperation with AFOSR

(Grant NGL-33-018-003)
(NASA-CR-176279; NAS 1.26:176279; SAPR-48) Avail: NTIS HC A05/MF A01 CSCL 11D

Various topics relating to composite structural materials for use in aircraft structures are discussed. The mechanical properties of high performance carbon fibers, carbon fiber-epoxy interface bonds, composite fractures, residual stress in high modulus and high strength carbon fibers, fatigue in composite materials, and the mechanical properties of polymeric matrix composite laminates are among the topics discussed. For individual titles, see N86-11294 through N86-11297.

N86-11294*# Rensselaer Polytechnic Inst., Troy, N. Y.
CONSTITUENT MATERIALS
In its Composite Struct. Mater. Aug. 1985 p 9-12 (For primary document see N86-11293 02-24)
Avail: NTIS HC A05/MF A01 CSCL 11D

This project is concerned with the study of polymer liquid crystals and oriented semicrystalline high-temperature thermoplastics in high modulus carbon fiber reinforced composites. Emphasis is being placed on the determination of the effects of polymer orientation at the fiber surfaces on composite fracture and mechanical properties. Author

N86-11295*# Rensselaer Polytechnic Inst., Troy, N. Y.
COMPOSITE MATERIALS
In its Composite Struct. Mater. Aug. 1985 p 13-25 (For primary document see N86-11293 02-24)
Avail: NTIS HC A05/MF A01 CSCL 11D

The deformation and failure behavior of graphite/epoxy tubes under biaxial (axial tension and torsion) loading is being investigated. The aim of this research is to increase basic understanding of and provide design information for the biaxial response of graphite/epoxy composites. Author

N86-11296*# Rensselaer Polytechnic Inst., Troy, N. Y.
GENERIC STRUCTURAL ELEMENTS
In its Composite Struct. Mater. Aug. 1985 p 27-37 (For primary document see N86-11293 02-24)
Avail: NTIS HC A05/MF A01 CSCL 11D

This research concentrated on improving beam theories as applicable to composite structures. Confirmation is sought for analytical predictions using a new beam theory based on the assumption that cross-sections of the beam are infinitely rigid in their own plane, but free to warp out-of-plane, of these analytical predictions were sought during the current reporting. Author

N86-11297*# Rensselaer Polytechnic Inst., Troy, N. Y.
PROCESSING SCIENCE AND TECHNOLOGY
In its Composite Struct. Mater. Aug. 1985 p 39-62 refs (For primary document see N86-11293 02-24)
Avail: NTIS HC A05/MF A01 CSCL 11D

The heat capacity at constant pressure,Cp, of poly-p-xylylene (PPX) was measured from 220 to 625 degrees K using differential scanning calorimetry. The heat capacities at constant volume, Cv, of both PPX and its isomer polystyrene (PS were interpreted using literature data on full normal mode calculations for PS and estimates from low molecular weight analogues for PPX for the 39 group vibrations. Nine skeletal vibrations were used with theta sub 1 and theta sub 3 temperatures of 534.5 degrees K and 43.1 degrees K for PS. It was also possible to calculate a heat capacity contribution of a phenylene group within a polymer chain. Single 48-vibration theta sub 1 temperatures of 3230 degrees K for PS and 2960 degrees K for PPX are sufficient to describe Cv above 220 degrees K. Below 140 deg K, PS heat capacity shows deviations from the Tarasov treatment. Author

N86-11298*# Missouri Univ., Rolla. Dept. of Engineering Mechanics.
INTERACTION OF MIXED MODE LOADING ON CYCLIC DEBONDING IN ADHESIVELY BONDED COMPOSITE JOINTS
S. Mall, M. A. Rezaizadeh, and G. Ramamurthy Oct. 1985 9 p refs
(Grant NAG1-425)
(NASA-CR-177990; NAS 1.26:177990) Avail: NTIS HC A02/MF A01 CSCL 11D

A combined experimental and analytical investigation of an adhesively-bonded composite joint was conducted to characterize the fracture mode dependence of cyclic debonding. The system studied consisted of graphite/epoxy adherends bonded with EC 3445 adhesive. Several types of specimens are tested which provide the cyclic debond growth rate measurements under various load conditions: mode 1, mixed mode 1 to 2, and mostly mode 2. This study shows that the total strain-energy-release rate is the governing factor for cyclic debonding. Author

N86-11299*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
MANUAL FOR LDEF TENSILE TESTS
William G. Witte, Jr. Oct. 1985 40 p refs
(NASA-TM-87624; NAS 1.15:87624) Avail: NTIS HC A03/MF A01 CSCL 11D

One of the experiments aboard the NASA Long Duration Exposure Facility (LDEF) consists of a tray of approximately one hundred tensile specimens of several candidate space structure composite materials. During the LDEF flight the materials will be subjected to the space environment and to possible contamination during launch and recovery. Tensile tests of representative samples were made before the LDEF flight to obtain baseline data. Similar tests will be made on control specimens stored on earth for the length of the LDEF flight and on recovered flight specimens. This manual codifies the details of testing, data acquisition, and handling used in obtaining the baseline data so that the same procedures and equipment will be used on the subsequent tests. Author

N86-11300# Martin Marietta Aerospace, Denver, Colo.
METALLURGICAL CHARACTERIZATION OF THE INTERFACES AND THE DAMPING MECHANISMS IN METAL MATRIX COMPOSITES Progress Report, 4 Feb. 1984 - 12 Jun. 1985
M. S. Misra 12 Jun. 1985 11 p
(Contract N00014-84-C-0413)
(AD-A156507; MCR-85-605-Issue-1; PR-1) Avail: NTIS HC A02/MF A01 CSCL 11/4

Metal matrix composites are candidate structural materials for space applications. Large structures in space encounter natural and hostile disturbances, which introduce vibrations of a broad spectrum of frequencies. These vibrations must be damped fast enough for effective maneuverability and dynamic dimensional precision. In the vibrational control designs of such structures, damping capacity of the structural material is a significant parameter. If metal matrix composites are to be used for space structures; their intrinsic damping behavior needs to be clearly understood and improved if necessary, through metallurgical modifications. In this report, a graphite-aluminum composite has been selected to study the microstructural features and mechanisms responsible for dissipating vibrational energy. The objectives of this program were to develop a reliable test technique to accurately measure the damping capacity of metal matrix composites; perform metallurgical characterization of the interface structures; investigate the damping mechanism in metal matrix composites; and recommend microstructural modifications to enhance damping in metal matrix composites. GRA

N86-11301# Oak Ridge National Lab., Tenn.
IMPROVEMENTS IN THE FABRICATION OF CERAMIC-FIBER-CERAMIC-MATRIX COMPOSITES BY CHEMICAL VAPOR INFILTRATION
A. J. Caputo, R. A. Lowden, and D. P. Stinton Jun. 1985 41 p
(Contract DE-AC05-84OR-21400)
(DE85-015971; ORNL/TM-9651) Avail: NTIS HC A03/MF A01

Development of a new, faster process for the fabrication of ceramic fiber reinforced ceramic matrix composites by chemical vapor infiltration has continued. Composites of SiC fibers infiltrated with a matrix of either SiC or Si3N4 were produced. Process and equipment improvements led to the fabrication of preforms with a higher fiber content, and infiltration improvements reduced

infiltration times and increased infiltrated densities. These improvements have produced composites with high flexural strengths (up to 475 MPa) and high strain values (up to 1%). The high strength and high strain values along with the gradual loss of strength (in contrast to the sudden loss typical of ceramics) is discussed. DOE

N86-11255*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
INITIAL INVESTIGATION OF CRYOGENIC WIND TUNNEL MODEL FILLER MATERIALS
George C. Firth *In its* Welding, Bonding and Fastening, 1984 Sep. 1985 p 465-481 refs (For primary document see N86-11227 02-23)
Avail: NTIS HC A21/MF A01 CSCL 11D

N86-11529# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
A REVIEW OF THE LITERATURE ON FINITE-ELEMENT MODELING OF LAMINATED COMPOSITE PLATES
J. N. Reddy *In* Shock and Vibration Information Center The Shock and Vibration Digest, Vol. 17, No. 4 Apr. 1985 p 3-8 refs (For primary document see N86-11527 02-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C., 20375 CSCL 11/4

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N86-11302# Air Force Academy, Colo.
IDENTIFICATION OF METAL ION CHLORO COMPLEXES IN AN AMBIENT TEMPERATURE MOLTEN SALT Interim Report, 6 Feb. 1984 - 6 Feb. 1985
G. F. Reynolds, T. B. Scheffler, and J. S. Wilkes 25 May 1985 29 p
(AD-A157295; FJSRL-TR-85-0002) Avail: NTIS HC A03/MF A01 CSCL 07/4

The chloro complexation of LiCl, AgCl, CdCl2, and ZnCl2 in a chloride ion rich ambient temperature chloroaluminate ionic liquid had been studied by nuclear magnetic resonance spectroscopy. Chloride ion reacts with added metal chloride salts according to the reversible reaction xCl(-) + MCl subscript m yields MCl subscript M + x superscript x-, where x is a small, positive integer. The proton chemical shift of the organic component of the molten salt is very sensitive to the free chloride concentration of the melt. Therefore, observing the change in the chemicals shifts of the organic cation with increasing amounts of added metal chloride salt allows the determination of the value of x. Results indicate the formation of LiCl2(-), AgCl2-, CdCl42(-), and ZnCl4(2-) at 30 C. In addition, and extended model for ion interactions in these melts is described. GRA

N86-11303# Naval Research Lab., Washington, D. C.
A MECHANISM FOR IGNITION OF HIGH-TEMPERATURE GASEOUS NITROMETHANE: THE KEY ROLE OF THE NITRO GROUP IN CHEMICAL EXPLOSIVES
R. Guirguis, D. Hsu, D. Bogan, and E. Oran 8 Jul. 1985 29 p (RR0-1306)
(AD-A157355; NRL-MR-5558) Avail: NTIS HC A03/MF A01 CSCL 07/3

A detailed chemical mechanism describing ignition of high-temperature pure gaseous nitromethane was compiled and tested using shock in the range of 1000 to 1600 K and 1 to 10 atm. Measurements were made of the time evolution of the pressure at the end wall, as well as of the simultaneous pressure and NO absorption at a short, fixed distance from the end wall. Mass and infrared spectoscopy were used to identify the final products. In the reaction mechanism proposed, initiation starts with the C-N bond breaking which yields CH3 and NO2. Methoxy and CH2NO2 propagation, initiation starts with the C-N bond breaking which yields CH and NO2. Methoxy and CH2NO2 radicals then propagate the reaction through two major parallel pathways, both producing CH2O. Formaldehyde is then reduced to HCO and careies the reaction towards completion. The radical reactions do not release enough energy to compensate for the energy consumed in breaking the C-N bond. Although most of the radicals reach their maximum concentration early in the reaction process, ignition does not occur until virtually all of the nitromethane is consumed. The calculations show that the nitro group is the key to explosion: NO2 produces OH through its reaction wilth H radicals. Hydroxyl reactions, which are fast and exothermic, lead an accelerated consumption to the explosive with heat release. Comparison with the experiments shows that the mechanism predicts correct induction times for the pressure and temperature range of the experiments. GRA

N86-11304# Eltron Research, Inc., Aurora, Ill.
INVESTIGATION OF PHOTOELECTRODE REDOX POLYMER JUNCTIONS Technical Report, 16 Nov. - 15 Jan. 1984
R. L. Cook and A. F. Sammells 15 Jan. 1985 14 p
(Contract N00014-84-C-0723)
(AD-A157556; Rept-0001AB) Avail: NTIS HC A02/MF A01 CSCL 07/4

The n-CdS flatband potential in the solid-state cell n-CdS/Nafion 117 + redox species/Au was shifted progressively in a cathode directed upon the introduction of FeCp2, FeCp2 + Ru(bpy)3(2+) into the SPE. This cathodic shift was consistent with that for the oxidation potentials seen for Ru(bpy)3(2+) (E1/2 = 1.25V vs SCE) and FeCp2 (0.285V vs SCE) in acetonitrile. Such perturbations of semiconductor properties can be expected to form the basis of a detector technology when the semiconductor/SPE junction is exposed to selected chemical species. GRA

N86-11305# California Univ., Livermore. Lawrence Livermore Lab.
FLUIDS AT HIGH DYNAMIC PRESSURES AND TEMPERATURES
W. J. Nellis, D. C. Hamilton, R. J. Trainor, H. B. Radousky, A. C. Mitchell, and N. C. Holmes Jun. 1985 10 p refs Presented at the 10th High Pressure Conf. on Res. in High Pressure Sci. and Technol., Amsterdam, 8 Jul. 1985
(Contract W-7405-eng-48)
(DE85-014812; UCRL-92924; CONF-850759-6) Avail: NTIS HC A02/MF A01

Electrical conductivity data for shocked liquid nitrogen, Hugoniot data for liquid air, shock temperatures for liquid ammonia, and double shock equation of state data for Al are discussed. The equation of state for ammonia is important for models of the outer planets Uranus and Neptune. DOE

N86-11959# Joint Publications Research Service, Arlington, Va.
SURFACE COMBUSTION OF LIQUID FUEL IN STREAM OF GASEOUS OXIDIZER Abstract Only.
N. I. Zverev and V. N. Smirnov *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 22 refs Transl. into ENGLISH from Fiz. Goreniya i Vzryva (Novosibirsk, USSR), v. 20, no. 6, Nov. - Dec. 1984 p 33-38 Original language doc. was announced as A85-25571 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

N86-11960# Joint Publications Research Service, Arlington, Va.
EXPLOSION WAVES GENERATED BY DEFLAGRATION COMBUSTION Abstract Only
V. A. Gorev and S. A. Bystrov *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 P. 22 refs Transl. into ENGLISH from Fiz. Goreniya i Vzryva (Novosibirsk, USSR), v. 20, no. 6, Nov. - Dec. 1984 p 26-33 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

N86-11963# Joint Publications Research Service, Arlington, Va.
CALCULATION OF FORMATION TIME OF MINIMAL NUCLEUS OF FLAME DURING IGNITION OF EXPLOSIVE MIXTURES BY ELECTRICAL DISCHARGES Abstract Only.
N. I. Lobyzov and N. M. Karmazinov *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 33 refs Transl. into ENGLISH from Fiz. Goreniya i Vzryva (Novosibirsk, USSR), v. 20, no. 6, Nov. - Dec. 1984 p 55-58 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

N86-11964# Joint Publications Research Service, Arlington, Va.
FLAME PROPAGATION IN PULSED ACCELERATION FIELD Abstract Only.
V. P. Samsonov *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 33 refs Transl. into ENGLISH from Fiz. Goreniya i Vzryva (Novosibirsk, USSR), v. 20, no. 6, Nov. - Dec. 1984 p 58-61 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

N86-11965# Joint Publications Research Service, Arlington, Va.
OCCURRENCE OF PRESSURE WAVE DURING SPONTANEOUS IGNITION OF GAS AHEAD OF FLAME FRONT IN CLOSED VESSEL Abstract Only.
V. I. Vodyanik and S. V. Tarakanov *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 36 refs Transl. into ENGLISH from Fiz. Goreniya i Vzryva (Novosibirsk, USSR), v. 21, no. 1, Jan. - Feb. 1985 p 49-53 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N86-11306 California Univ., Los Angeles.
ACOUSTIC EMISSION DURING DEFORMATION AND FRACTURE OF A533B PRESSURE VESSEL STEEL Ph.D. Thesis
Jong Bee Teoh 1984 209 p
Avail: Univ. Microfilms Order No. DA8505678

The acoustic emission (AE) characteristics of ASTM A533B steel during tensile and fracture testing are highly anisotropic, originating from the decohesion of flattened MnS inclusions. This source of AE and effects of various heat treatment practices on the MnS/matrix interfaces is explored. The AE characteristics associated with different fracture mechanisms are identified, and the effects of test temperature and notch geometry examined. During fracture testing, slow bend tests were performed on Charpy V-notch samples at temperatures from -75 to 150 C. Tests were also interrupted so as to isolate the fracture processes. Tear and shear fracture and dimple formation by microvoid coalescence generated low amplitude AE events. Quasi-cleavage and cleavage fracture processes emitted events with a broad range of amplitude. Decohesion of MnS showed the charactristic Weibull distribution. When decohesion occurs, AE events from this process would mask those from other processes except cleavage or quasi-cleavage. Dissert. Abstr.

N86-11307 Virginia Polytechnic Inst. and State Univ., Blacksburg.
ENVIRONMENTAL EFFECTS IN THE FATIGUE BEHAVIOR OF COPPER NICKEL ALLOYS Ph.D. Thesis
Tirumali Srinivas Sudarshan 1984 271 p
Avail: Univ. Microfilms Order No. DA8511954

Mode 1 and Mode 3 fatigue tests were performed on copper nickel alloys in helium, hydrogen, oxygen, air and salt water environments. The two alloys used this investigation were 90/10 and 70/30 copper/nickel. Both alloys contained iron which was added to improve the erosion corrosion resistance. The extent of cracking varied with the test environment. Tests showed that oxygen and humid air promoted cracking while salt water retarded cracking when helium was used as the baseline environment. Hydrogen promoted cracking when compared to helium but retarded cracking if comparisons were made with oxygen or humid air. Observations suggest that the presence of iron accelerates fatigue in copper nickel alloys exposed to aggressive environments. Thus, any application involving fatigue loading with simultaneous exposure to aggressive environments should attempt to ensure that the iron content of the copper nickel alloys is minimized. Dissert. Abstr.

N86-11308 California Univ., Berkeley.
THE HOLLOW SPHERE MODEL FOR POROUS METALS AND METAL POWDERS Ph.D. Thesis
Kitae Kim 1984 109 p
Avail: Univ. Microfilms Order No. DA8512880

The effect of strain hardening on compaction behavior of metal powders and porous metals is investigated by including strain hardening in the hollow sphere model of Torre and of Carroll and Holt. For various forms of the strain hardening law, theoretical compaction equations are obtained in terms of elementary functions. For a particular value of the characteristic strain in the saturation hardening law of Voce and Palm, the well known empirical equation of Shapiro and Kolthoff and of Konopicky is obtained. Some other hardening laws are also introduced, e.g., one for which the ultimate strength is unbounded. Because of the possibility oof nonsaturation hardening for some materials, the models presented have capabilities for fitting strain hardening data and the corresponding compaction data at a high density level. With regard to the micromechanical modeling of porous materials in tensile stress fields, spherical inflation problems are treated. The theory of unloading for compaction of an elastic perfectly plastic hollow sphere is introduced. Dissert. Abstr.

N86-11309 Stanford Univ., Calif.
CREEP AND FRACTURE OF A YTTRIA DISPERSED NICKEL-CHROMIUM ALLOY Ph.D. Thesis
John Joseph Stephens, Jr. 1985 248 p
Avail: Univ. Microfilms Order No. DA8511358

The high temperature longitudinal creep and fracture properties of a mechanically alooyed, nickel based yttria dispersion strengthened alloy, Inconel MA 754, have been examined. Two major creep deformation regimes are observed in the temperature range 1000 to 1200 C (0.76 to 0.88 T sub m). At high stresses a high stress exponent regime is encountered, with transgranular fracture and relatively high creep ductility. The strong [100] < 001 > texture of MA 754 and the high stress exponents (n approx. - 40), suggest that deformation at high stresses in MA 754 is essentially single crystal behavior. A second regime of creep deformation is observed at low stresses. Here, a relatively low stress exponent is measured, and intergranular fracture is observed along with a decline in creep ductility. Creep resistance at low stresses is determined by the grain morphology. Electron Microprobe Analysis and Transmission Electron Microscopy indicate that cavity growth leading to intergranular fracture occurs by means of a diffusive growth mechanism. Dissert. Abstr.

N86-11310 Metals Society, London (England).
CORROSION TESTING BY RADIOGRAPHIC METHODS
G. DelojoMorcillo and J. delosRiosRubalcaba Oct. 1984 13 p refs Transl. into ENGLISH from Rev. de Soldadura (Spain), no. 2, Apr. - Jun. 1982 p 39-43
(BLL-BISI-Trans-23201-(9022.06)) Avail: British Library Lending Div., Boston Spa, Engl.: £10.00; overseas $22.50

Radiography, which was developed in its quantitative aspects recently, is discussed. It supplies qualitative information which is not always accurate. The need for quality, and other testing methods, which are capable of an accurate detection, location, and measuring contributes to the development of radiographic techniques which give quantitative evaluations of the discontinuities discovered by the method. To obtain accurate quantitative results it is essential to have means to position sources and films with great accuracy, to employ carefully standardized laboratory

techniques, to apply a working style quite different from the usual one, and to have sensitive densitometric equipment. Author

N86-11311 Metals Society, London (England).
THE YIELD POINT OF COPPER-ZINC ALLOYS IN THE ALPHA SOLID SOLUTION RANGE
J. Gryziecki Oct. 1984 13 p refs Transl. into ENGLISH from Rudy Metale Niezelazne (Katowice), no. 10, 1983 p 373-376
(BLL-BISI-Trans-23046-(9022.06)) Avail: British Library Lending Div., Boston Spa, Engl.: £14.25; overseas $33.75

The effect of mechanical factors and external conditions on the lower yield point value and on the length of Luder bands is shown. The effect of grain size on the yield point value of copper zinc alloys deformed in the temperature range of 77 to 723 K which is based on the Hall-Petch relationship are discussed. E.A.K.

N86-11312*# Kentron International, Inc., Hampton, Va. Aerospace Technologies Div.
MECHANICAL PROPERTIES OF INCONEL 718 AND NICKEL 201 ALLOYS AFTER THERMAL HISTORIES SIMULATING BRAZING AND HIGH TEMPERATURE SERVICE
William F. James Sep. 1985 28 p refs
(Contract NAS1-18000)
(NASA-CR-177940; NAS 1.26:177940) Avail: NTIS HC A03/MF A01 CSCL 11F

An experimental investigation was made to evaluate two nickel base alloys (Nickel-201 and Inconel-718) in three heat treated conditions. These conditions were: (1) annealed; (2) after thermal exposure simulating a braze cycle; and (3) after a thermal exposure simulating a braze cycle plus one operational lifetime of high temperature service. For the Nickel-201, two different braze cycle temperatures were evaluated. A braze cycle utilizing a lower braze temperature resulted in less grain growth for Nickel-201 than the standard braze cycle used for joining Nickel-201 to Inconel-718. It was determined, however, that Nickel-201, was marginal for temperatures investigated due to large grain growth. After the thermal exposures described above, the mechanical properties of Nickel-201 were degraded, whereas similar exposure on Inconel-718 actually strengthened the material compared with the annealed condition. The investigation included tensile tests at both room temperature and elevated temperatures, stress-rupture tests, and metallographic examination. Author

N86-11313# Korrosionsinstitutet, Stockholm (Sweden).
CATHODIC PROTECTION OF ALUMINIUM STRUCTURES Abstract Only
Bertil Sandberg and Avtandil Bairamov 1985 4 p
(KiS-1985:4E) Avail: NTIS HC A02/MF A01

A study of the literature and a laboratory investigation of cathodic protection of aluminum structures is discussed. In the laboratory investigation the effect of the protection was studied in fresh water. In cathodic protection of aluminum complete cathodic protection is not striven for. The object is, instead, to counteract localized attack, chiefly pitting, and thus to prolong the life of the structure. Cathodic protection can in practice be achieved by three different principles: with impressed current, with sacrificial anodes, or by cladding such as Alclad. The results both of the study of the literature and of the laboratory investigation indicate that the lower limit is in practice below the -1130 mV rel. There is much to suggest that the interval in neutral electrolytes extends down to -1380 mV. Author

N86-11314# Korrosionsinstitutet, Stockholm (Sweden).
SHORT-TERM METHODS FOR ATMOSPHERIC CORROSION TESTING: SURVEY OF THE LITERATURE Abstract Only
Eva Johansson [1984] 2 p
(KiS-1985:5E) Avail: NTIS HC A02/MF A01

Different procedures for producing wetting and a sulfur dioxide bearing test atmosphere are dealt with. The study allows the following conclusions: (1) there are many standardized methods for atmospheric corrosion testing in which corrosion is accelerated by condensation, spraying of chloride solutions or addition of atmospheric pollutants; (2) the number of standardized methods that include cleaning of the specimen surface is limited; (3) several studies with salt spray tests have shown poor conformity with field exposures; and (4) short term tests with lower SO2 content and tests including cleaning of the specimen surface have yielded more promising results, compared with field exposures, than tests in which the SO2 content was higher and no cleaning took place. Author

N86-11315# Department of the Navy, Washington, D. C.
CHEMICAL BONDING AGENT FOR SUPPRESSION OF RUSTY BOLT INTERMODULATION INTERFERENCE Patent Application
J. C. Cooper, inventor (to Navy) Filed 23 Apr. 1985 20 p
(AD-D011747; US-Patent-Appl-SN-726563) Avail: NTIS HC A02/MF A01 CSCL 20/3

Intermodulation interference (IMI) occurrs when high frequency (HF) transmitters and receivers are placed in close proximity, particularly on ships and aircraft, due to non-linear conduction through metal-oxide-metal (MOM) junctions in the supporting structure. Welding or clamping straps cannot be used where there is a multiplicity of MOM junctions, such as in chains or twisted cable, or where dissimilar metals are involved. Additionally, the use of non-conductive materials or conductive straps is very expensive. To overcome these limitations while effectively reducing IMI, an inexpensive method that maintains the structural integrity of supporting hardware while providing a highly conductive current path is required. The chemical composition of the present invention used to overcome IMI contains compounds similar to rust removal compositions which have incorporated the general principles of chelating the ferric ion, incorporating the ion into a polymer material, and removing the rust with one polymer material. GRA

N86-11316# California Univ., San Diego, La Jolla. Dept. of Electrical Engineering and Computer Sciences.
SURFACE AND INTERFACIAL PROPERTIES OF Ga0.47In0.53As ALLOYS Final Report, 1 Apr. 1984 - 31 Mar. 1985
H. H. Weider 15 Jul. 1985 15 p
(Contract N00019-84-C-0169)
(AD-A157343) Avail: NTIS HC A02/MF A01 CSCL 11/6

A modified Varian GenII, molecular beam epitaxial deposition system was installed and preliminary performance tests have indicated its suitability for growing binary and ternary 3 to 5 alloy semiconducting layers. Gallium arsenide layers grown with this MBE system have electrical properties which compare well with those of the best layers grown elsewhere. One 50 layer GaAs/Ga sub x Al sub 1-x (160 A per layer thick) superlattice was used to test the usefulness of the MBE system for the synthesis of conventional heterojunctions and superlattices. Preliminary results have been obtained with Ga sub 0.47 In sub 0.53 As epitaxial layers whose lattice constant matches exactly that of their InP substrates. Work is underway on the synthesis of the ternary alloy layers and heterojunctions whose lattice constants match that of InP. Author (GRA)

N86-11317# Michigan Technological Univ., Houghton. Dept. of Metallurgical Engineering.
DEFORMATION AND FRACTURE OF P/M TITANIUM ALLOYS Final Report, 1 Jul. 1975 - 30 Sep. 1984
D. A. Koss May 1985 33 p
(Contract N00014-76-C-0037)
(AD-A157416; TR-28) Avail: NTIS HC A03/MF A01 CSCL 11/6

Progress is reviewed for a research program whose primary purpose has been to provide a broad-based understanding of the deformation and fracture of high performance alloys in general and titanium alloys in particular. The research has ranged from strengthening mechanisms in titanium alloys to fundamental studies of crack propagation, localized necking, hydrogen embrittlement, and ductile fracture utilizing engineering alloy behavior. Progress for the period 1 July 1975 to 1 October 1984 is reviewed for the following portions of this research program: (1) the influence of

silicon on the age hardening of beta-phase Ti alloys, (2) the flow and fracture behavior of multi-phase alloys with lamellar microstructures, (3) fracture along planar slip bands, (4) the multiaxial deformation and fracture of plastically anisotropic alloys in the form of sheet, (5) the influence of stress state on the hydrogen embrittlement of hydride-forming alloys in general and Ti in particular, and (6) the deformation and fracture of alloys containing pores and voids. GRA

N86-11318# Dayton Univ., Ohio. Research Inst.
EFFECTS OF MANUFACTURING PROCESSES ON STRUCTURAL ALLOWABLES Final Technical Report, Feb. 1983 - Nov. 1984
P. E. Doepker May 1985 180 p
(Contract F33615-82-C-5102)
(AD-A157596; UDR-TR-84-133; AFWAL-TR-85-4049) Avail: NTIS HC A09/MF A01 CSCL 11/6

This report documents the results from tests to determine mechanical property data for materials having various manufacturing processes. The materials tested were: 15-5 PH (H1025) Stainless Steel Alloy Hot Rolled Plate, 7175-T736 Aluminum Alloy Hand Forging and 7050-T736511 Aluminum Alloy Extrusion. Tensile, compression, shear and bearing properties were obtained for all three materials. Fatigue (notched and unnotched) properties were determined for the Stainless Steel Plate and the 7175-T736 Aluminum Hand Forging. GRA

N86-11319# Argonne National Lab., Ill.
DENSE RANDOM PACKED MODEL FOR AMORPHOUS Ni35-Zr65: INFLUENCE OF THE HEAT OF MIXING
C. K. Saw and R. B. Schwarz May 1985 7 p Presented at the Intern. Conf. on the theory of the Struct. of Non-Crystalline Solids, Bloomfield Hills, Mich., 3 Jun. 1985
(Contract W-31-109-eng-38)
(DE85-014967; CONF-8506144-3) Avail: NTIS HC A02/MF A01

The structure of amorphous Ni35Zr65 alloy was simulated by a Dense Random Packed (DRP) model. The model was relaxed by minimizing its elastic energy through the use of a modified Keating potential that included only central forces with interatomic bonds of equal strength. The Bathia-Thornton number concentration (NC) distributions and the Warren chemical short range order parameter, (ALPHA) sub w, were deduced from the model and compared with measurements in rapidly quenched Ni35Zr65. The DRP model simulates a truly random alloy for which (ALPHA) sub w = 0. Since (ALPHA) sub w = 0.04 for the actual alloy, the fraction of Ni-Zr nearest neighbors in the alloy exceeds that in the model. The effects of decreasing the strength of any one of the interatomic bonds (Ni-Ni, Ni-Zr, or Zr-Zr) were investigated. It was found that the bond relaxations cause a sharpening of some of the peaks in NC distributions but have no effect on the value of (ALPHA) sub w. The effect of permuting Ni and Zr atoms, so as to increase the number of Ni-Zr nearest neighbors at the expense of Ni-Ni and Zr-Zr pairs, was also investigated. DOE

N86-11320# Los Alamos National Lab., N. Mex.
LOS ALAMOS UPGRADE IN METALLOGRAPHIC CAPABILITIES
J. M. Ledbetter, K. E. Dowler, and J. H. Cook 1985 5 p Presented at the Am. Nucl. Soc. Winter Meeting, San Francisco, 10 Nov. 1985
(Contract W-7405-eng-36)
(DE85-014089; LA-UR-85-2193; CONF-851115-4) Avail: NTIS HC A02/MF A01

The Los Alamos Wing 9 Hot Cell Facility is in the process of upgrading their metallographic sample preparation and examination capability. The present capability to grind, polish and etch samples from reactor fuels and materials has been in operation for 18 years. Macro photography and alpha and beta gamma autoradiography are an important part of this capability. Some of the fast breeder reactor experiments have contained sodium as a coolant. Therefore, the capability to distill sodium from some samples scheduled for microstructural examinations is a requirement. Since the reactor fuel samples are highly radioactive and contain plutonium, either as fabricated or as a result of breeding during reactor service, these samples must be handled in shielded hot cells containing alpha boxes to isolate the plutonium and hazardous fission products from personnel and the environment. Ideas that were developed during the design of new alpha boxes and new equipment for microstructural sample preparation have provided the concepts for the capability to perform the work faster and maintain the equipment in a safer manner. DOE

N86-11321# Sandia Labs., Albuquerque, N. Mex.
STRESS AND STRAIN-RATE DEPENDENCE OF SPALL STRENGTH IN TWO ALUMINUM ALLOYS
D. R. Ek and J. R. Asay 1985 6 p Presented at the Am. Phys. Soc. Topical Conf. on Shock Waves in Condensed Matter, Spokane, 22 Jul. 1985
(Contract DE-AC04-76DP-00789)
(DE85-015154; SAND-85-0156C; CONF-850736-41) Avail: NTIS HC A02/MF A01

The spallation behavior of 6061-T6 and AMg-6 aluminum alloys is studied as a function of loading stress and initial pulse duration for stress amplitudes ranging from 5 to 20 GPa and for pulse durations spanning range of 0.06 to 0.9 microns. These experiments show that the spallation strength varies from about 0.7 to 1.4 GPa for strain rates varying from 0.15 to 1 microns/sec and for impact stresses from 5 to 20 GPa. Author

N86-11322# California Univ., Berkeley. Lawrence Berkeley Lab.
ELECTRONIC AND MAGNETIC STRUCTURE OF CHROMIUM SURFACES AND CHROMIUM MONOLAYERS ON IRON
R. H. Victora and L. M. Falicov May 1985 13 p Presented at the Intern. Conf. on Magnetism, San Francisco, 26 Aug. 1985
(Contract DE-AC03-76SF-00098)
(DE85-014542; LBL-19722; CONF-850890-2) Avail: NTIS HC A02/MF A01

Chromium surfaces and Cr monolayers atop Fe have greatly enhanced magnetizations relative to bulk. The Cr (100) surface is ferromagnetic with a spin polarization of 3.00; the (110) surface is antiferromagnetic. A Cr monolayer is ferromagnetic atop either the (100) or (110) Fe surfaces; the former has a large polarization of 3.63. DOE

N86-11323# Los Alamos National Lab., N. Mex.
MAGNETIC PROPERTIES AND ELECTRONIC STRUCTURE OF THE ACTINIDE SYSTEMS UAl2, NpAl2 AND PuAl2
R. C. Albers, A. M. Boring, and D. D. Koelling 1985 11 p Presented at the Intern. Conf. on Magnetism, San Francisco, 26 Aug. 1985 Prepared in cooperation with ANL, Ill.
(Contract W-7405-eng-36)
(DE85-014102; LA-UR-85-2140; CONF-850890-4) Avail: NTIS HC A02/MF A01

The electronic ground states of UAl2, NpAl2 and PuAl2 were determined by band theory techniques. These calculations indicate that both actinide d-f hybridization and spin-orbit coupling are important in these systems. Using a new scheme for obtaining the paramagnon parameters for UAl2 it is shown that calculated and experimentally derived 5f band width are consistent. The fact that orbital angular momentum may not be quenched in these systems is suggested as a possible mechanism for damping spin-fluctuations in NpAl2 and PuAl2. DOE

N86-11324# North Carolina State Univ., Raleigh.
SHOCK-WAVE SYNTHESIS OF TITANIUM ALUMINIDES
Y. Horie, D. E. P. Hoy, I. Simonsen, R. A. Graham, and B. Morosin 1985 7 p Presented at the Am. Phys. Soc. Topical Conf. on Shock Waves in Condensed Matter, Spokane, 22 Jul. 1985 Prepared in cooperation with Sandia National Labs., Albuquerque, N. Mex.
(Contract DE-AC04-76DP-00789)
(DE85-015140; SAND-85-0484C; CONF-850736-33) Avail: NTIS HC A02/MF A01

The initiation of strong chemical reactions in a mixture of Ti and Al powders subject to high pressure shock wave loading was observed when the bulk peak temperature of the region calculated

from numerical simulation was above 450 C. A high temperature with a high pressure does not promote reactions with significant yield. A reaction product has hardness twice the values for Ti rich equilibrium compounds in the Ti-Al system. There is lack of agreement between X-ray analysis and EPMA regarding the composition of the products. The X-ray diffraction showed the pattern for TiAl3 or its two ordered superstructures while EPMA favored Ti rich compounds - Ti2Al and TiAl. DOE

N86-11325# Sandia Labs., Albuquerque, N. Mex.
CHEMICAL SYNTHESIS UNDER SHOCK COMPRESSION
R. A. Graha, B. Morosin, Y. Horie, E. L. Venturini, M. Boslough, M. J. Carr, and D. L. Williamson 1985 19 p refs Presented at the Am. Phys. Soc. Topical Conf. on Shock Waves incondensed Matter, Spokane, 22 Jul. 1985 Prepared in cooperation with North Carolina State Univ., Raleigh and Colorado School of Mines, Golden
(Contract DE-AC04-76DP-00789)
(DE85-015166; SAND-85-0366C; CONF-850736-39) Avail: NTIS HC A02/MF A01

Many reports of chemical synthesis under high pressure shock loading have been published over the past thirty years, but little progress has been made in developing an understanding of the mechanisms responsible for the observed effects. This paper discusses the current status of studies in shock-induced solid state chemistry. It is observed that it is relatively easy to initiate and control chemical reactions in shock-loaded powder materials. In solids it is well known that chemical changes are controlled by defects at all levels from atomic and microstructural to continuum. A major program to study shock-induced modification of inorganic powders provides explicit evidence for unusually large plastic deformation and resulting defect structures. Shock-modified powders also show major enhancements in solid state reactivity in post-shock experiments. Currently, two systems are found to provide a basis for studying controlled chemical synthesis. Intermetallic alloys have been found to be produced in a controlled manner from mechanical mixtures of aluminum with either nickel or titanium. Optical measurements show that a strong chemical reaction is induced on a 100 nanosecond time scale in such aluminum-nickel mixtures under shock compression. DOE

N86-11326# California Univ., Livermore. Lawrence Livermore Lab.
PROCESSING AND MICROSTRUCTURAL CHARACTERIZATION OF B4C-Al CERMETS
D. C. Halverson, A. J. Pyzik, and I. A. Aksay Feb. 1985 21 p refs Presented at the 9th Ann. Conf. on Composites and Advan. Ceram. Mater. and Workshop on Testing Methods for Ceram. Matrix Composites, Cocoa Beach, Fla, 20 Jan. 1985 Prepared in cooperation with Washington Univ., Seattle
(Contract W-7405-eng-48)
(DE85-013195; UCRL-91305; CONF-850122-10) Avail: NTIS HC A02/MF A01

Reaction thermodynamics and wetting studies were employed to evaluate boron carbide-aluminum cermets. Wetting phenomenon and interfacial reactions are characterized using macroscale and microscale techniques. Macroscale evaluation involves aluminum sessile drop studies on boron carbide substrates. Microscale evaluation involves the fabrication of actual cermet microstructures their characterization through SEM, X-ray diffraction, metallography, and electron microprobe. Contact-angle measurements and interfacial-reaction products are reported. DOE

N86-11327# Rockwell International Corp., Golden, Colo.
METALLOGRAPHY OF SOLID STATE BONDS
W. L. Johns and J. H. Doyle 1985 35 p Presented at the Intern. Met. Soc. Conf., Denver, 21 Jul. 1985
(Contract DE-AC04-76DP-3533)
(DE85-014564; RFP-3847; CONF-850753) Avail: NTIS HC A03/MF A01

Two methods of bonding dissimilar metals are described: silver-assisted solid state bonding and friction welding. Both methods can produce bonds that are very strong at room temperature with ultimate strengths greater than the lower strength metal. Two distinct types of defects have been observed in friction welds between 1100 aluminum and 316 stainless steel: voids or tearing at the bond interface and formation of brittle intermetallic. Silver-assisted solid state bonds are made that have very high ultimate strengths. In the case of 1100 aluminum bonded to 316 stainless steel, as-machined surfaces are adequate. There is a definite relationship between silver microstructure and substrate temperature. The microstructures produced have significant differences in hardness and ductility. A change in microstructure does not appear to have any effect on the resulting bond strength. Low bonding pressure and/or temperature can result in low strength failures. High bonding temperatures can result in the growth of brittle intermetallics. DOE

N86-11328# New Mexico Inst. of Mining and Technology, Socorro.
SYNTHESIS OF NICKEL-ALUMINUM ALLOYS BY SHOCK COMPRESSION OF COMPOSITE PARTICLES
H. R. Pak, Y. Horie, and R. A. Graham 1985 7 p Presented at the Am. Phys. Soc. Topical Conf. on Shock Waves in Condensed Matter, Spokane, 22 Jul. 1985 Prepared in cooperation with North Carolina State Univ., and Sandia Labs.
(Contract DE-AC04-76DP-00789)
(DE85-015165; SAND-85-03330; CONF-850736-40) Avail: NTIS HC A02/MF A01

Electron microscope observations of compound formation in Ni/Al composite powders by shock loading is reported. Reactions with substantial yield are seen in outer areas of a recovered specimen, while unreacted or locally reacted regions are seen in the center and middle areas of the specimen. Ni3Al is formed in a gamma solid solution of Ni. The microstructure is very complex. DOE

N86-11329# Mound Lab., Miamisburg, Ohio.
INJECTION MOLDING-SEALING OF GLASS TO LOW MELTING METALS Final Report
D. P. Kramer, R. T. Massey, and D. D. Halcomb 15 Jul. 1985 12 p
(Contract DE-AC04-76DP-00053)
(DE85-015613; MLM-3268) Avail: NTIS HC A02/MF A01

The fabrication of complex glass or glass ceramic to metal seals which use low melting metals such as aluminum. During injection molding sealing, molten glass, which may have a higher melting temperature than that of the metal parts, is injected under pressure into the metal parts while they are held in a mold. The process, which for the first time allows the formation of seals with metals that have a lower melting temperature than the glass, allows the fabrication of seals of simplex geometry. DOE

N86-11330# Brandeis Univ., Waltham, Mass.
A 2D ACAR MOMENTUM DENSITY STUDY OF THE NATURE OF THE POSITRON SURFACE STATE ON Al(100)
S. Berko, K. F. Canter, K. G. Lynn, A. P. Mills, L. O. Roellig, and R. N. West 1985 4 p refs Presented at the 7th Intern. Conf. on Positron Annihilation, New Delhi, 6 Jan. 1985 Prepared in cooperation with BNL, Upton, N.Y., Bell Telephone Labs., Murray Hill, N.J., City Coll. of the State of New York, N.Y. and East Anglia Univ., Norwich, Engl.
(Contract DE-AC02-76CH-00016)
(DE85-014830; BNL-36701; CONF-850169-17) Avail: NTIS HC A02/MF A01

The two dimensional angular correlation of the 2(GAMMA) annihilation radiation (2D ACAR) has been measured from an Al(100) surface bombarded by 200 eV positrons. After removing the contribution of fast parapositronium annihilation, the spectrum from positrons annihilating at the surface exhibits a nearly isotropic conical shape with a (7.1 + or - 0.5) mrad FWHM. DOE

N86-11331# Oak Ridge National Lab., Tenn.
ITINERANT ELECTRON FERROMAGNETISM IN Fe-ALLOYED, Ni3Al BASED MATERIALS
J. R. Thompson, H. R. Kerchner, and S. T. Sekula 1985 11 p Presented at the Intern. Conf. on Magnetism, San Francisco,

26 Sep. 1985
(Contract DE-AC05-84OR-21400)
(DE85-013989; CONF-8509102-1) Avail: NTIS HC A02/MF A01

Bulk magnetic properties of Ni3Al based alloys containing up to 10 at.% Fe have been investigated. The experimental results are compared with those for off stoichiometry Ni3Al and interpreted using Stoner and SCB spin fluctuation theory. DOE

N86-11332# Oak Ridge National Lab., Tenn.
TENSILE PROPERTIES OF 2-1/4Cr-1Mo STEEL IRRADIATED TO 23 dpa AT 390 TO 550(0)C
R. L. Klueh and J. M. Vitek 1985 29 p
(Contract DE-AC05-84OR-21400)
(DE85-015551; DOE/OR-21400/T99) Avail: NTIS HC A03/MF A01

The effect of neutron irradiation on the tensile properties of normalized and tempered 2-1/4Cr-1Mo steel was determined for specimens irradiated to 23 dpa in the Experimental Breeder Reactor II (EBR-II) at 390, 450, 500, and 550 C. Two types of unirradiated control specimens were tested: as heat treated specimens and as heat treated specimens thermally aged for 10,000 h at the irradiation temperatures. Aging caused a loss of strength at all four temperatures. Irradiation at 390 C increased the strength and decreased the ductility compared to the control specimens. At 500 and 550 C, softening occurred relative to the thermally aged specimens, with the amount of softening greatest at 550 C. At 450 C, the strength of the irradiated specimens was similar to a specimen aged 10,000 h at 450 C. The changes in tensile properties result from the displacement damage caused by the irradiation induced changes in carbide precipitates that occur during elevated temperature exposure. DOE

N86-11333# Sandia Labs., Albuquerque, N. Mex.
INFLUENCE OF EFFECTIVE RATE SENSITIVITY ON ADIABATIC SHEAR INSTABILITY
T. J. Burns 1985 8 p refs Presented at the Intern. Conf. on Met. Appl. of Shock Wave and High-Strain Rate Phenomena, Portland, Oreg., 28 Jul. 1985
(Contract DE-AC04-76DP-00789)
(DE85-013967; SAND-85-0280C; CONF-850889-1) Avail: NTIS HC A02/MF A01

An analysis is presented of the stability of dynamic simple shear in a ductile metal whose yield behavior is described by a mechanical flow rule, i.e., a material whose flow stress depends only on the instantaneous values of strain, strain rate, and temperature. It is shown that near the yield point, a region which usually has been ignored in shear stability studies, the steepness of the slope of the stress versus strain curve of the material can be large enough for inertial effects to dominate over viscous effects for short time, so that the process effectively has a rate sensitivity at early time which is much smaller than the coefficient of rate sensitivity typically measured during an experiment. This combination of inertial effects and smaller viscous effects can be sufficient to cause only the longer-wavelength components of a perturbation on simple shear to retain much energy after a small amount of plastic flow, and thus it provides an explanation for the apparent growth of only longer-wavelength modes once the material begins to soften due to adiabatic heating and becomes unstable. The conclusions of this work should also apply to other materials testing experiments, such as the loading of bars in tension. DOE

N86-11334# Arizona Univ., Tucson.
SHORT RANGE BONDING INTERACTION AT METAL-METAL INTERFACES
W. R. Bennett, J. A. Leavitt, and C. M. Falco 1984 2 p Presented at the Course on Dyn. Phenomena at Surfaces, Interfaces and Superlattices, Erice, Italy, 1 Jul. 1984
(Contract DE-AC02-83ER-45025)
(DE85-014442; DOE/ER-45025/5; CONF-8407117-3) Avail: NTIS HC A02/MF A01

Freshly deposited Mo surfaces were exposed to a beam of sputtered Ta atoms for varying, controlled lengths of time. The resultant number of deposited Ta atoms/cm(2) was subsequently measured using Rutherford Backscattering. DOE

N86-11335# Brookhaven National Lab., Upton, N. Y.
INTERGRANULAR ATTACK AND STRESS CORROSION CRACKING OF ALLOY 600 IN HIGH-TEMPERATURE CAUSTIC SOLUTIONS CONTAINING CONTAMINANTS
R. Bandy, R. Roberge, and D. vanRoyen Jun. 1985 73 p
(Contract DE-AC02-76CH-00016)
(DE85-014106; EPRI-NP-4051) Avail: NTIS HC A04/MF A01; available from Research Reports Center, Box 50490, Palo Alto, Calif. 94303

Concentrated caustic is a primary cause of stress corrosion cracking and intergranular attack of Alloy 600 tubing in PWRS. However, temperature, electrochemical potential, stress, and metallurgical state all play a role. This study provides the quantitative evidence needed to develop models of crack growth and to devise effective countermeasures. DOE

N86-11336# Sandia Labs., Albuquerque, N. Mex.
CALCULATION OF THERMAL TRAPPING IN SHEAR BANDS
J. W. Swegle and D. E. Grady 1985 48 p Presented at the Intern. Conf. on Met. Appl. of Shock Wave and High-Strain Rate Phenomena, Portland, Oreg., 28 Jul. 1985
(Contract DE-AC04-76DP-00789)
(DE85-014404; SAND-85-0269C; CONF-850889-2) Avail: NTIS HC A03/MF A01

The microstructure associated with heterogeneous shear deformation observed in shock-loaded materials implies the possibility of transient local temperatures which far exceed those expected under homogeneous deformation. The possible consequences of high local temperatures and resulting thermal softening are explored by using thermodynamic considerations to derive equations for the evolution of shear band temperatures. Inclusion of the equations in a finite-difference wavecode along with a previously developed model which accurately describes shockwave risetime behavior, allows calculation of temperature states in the shock front. At low stresses, risetimes are long compared to thermal diffusion times and shear bands that stay in thermal equilibrium with surrounding material, but at high stresses where risetimes are very short, shear band temperatures greatly exceed bulk temperatures before thermal equilibrium occurs. Decreasing yield strength with increasing shear band temperature followed by yield strength recovery as the shear bands cool produces an elastic precursor on reshock which cannot be obtained with standard elastic-plastic models. DOE

N86-11337# Sandia Labs., Albuquerque, N. Mex.
RELATIONSHIP BETWEEN INTERATOMIC BONDING AND ELECTRON TRANSPORT IN PLASMA DEPOSITED AMORPHOUS METAL ALLOYS
G. E. Pike, A. K. Hays, G. C. Nelson, and I. J. Fritz 1985 6 p refs Presented at the 2d Spring Meeting of the Mater. Res. Soc., San Francisco, 15 Apr. 1985
(Contract DE-AC04-76DP-00789)
(DE85-014710; SAND-85-0913C; CONF-850421-12) Avail: NTIS HC A02/MF A01

Amorphous metal alloy films have been produced using a new technique. Nominally NiP alloys are made by dissociating mixtures of nickel carbonyl and phosphine using a radio-frequency discharge in either an argon or a hydrogen carrier gas. This process incorporates significant amounts of carbon and oxygen impurities into the film. A previously unreported relationship between the interatomic bonding involving these impurities and the electronic transport properties of the films is discussed in this paper. The bonding studies were carried out principally using Auger lineshape analysis. Transport properties measured included 4-terminal resistivities, Hall mobilities and carrier concentrations, and Seeback coefficients. Covalent bonding of Ni with C or P with O is strongly correlated with high resistivity, mainly through a decrease in carrier density. DOE

N86-11338# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
MECHANICAL PROPERTIES OF RAPIDLY SOLIDIFIED TYPE 304 STAINLESS STEEL
G. E. Korth and J. E. Flinn 1985 33 p Presented at the 114th AIME Ann. Meeting, New York, 24 Feb. 1985; sponsored in part by Society of Mining Engineers
(Contract DE-AC07-76ID-01570)
(DE85-014577; EGG-M-02285; CONF-850211-11) Avail: NTIS HC A03/MF A01

Rapidly solidified Type 304 stainless steel (SS) powder produced by the centrifugal atomization process was consolidated by hot extrusion techniques. Tensile, creep-rupture, and fatigue tests were performed on the extruded material and the mechanical properties data are compared with those of conventionally prepared wrought material. The properties of the rapidly solidified material are superior or equivalent to conventional Type 304 SS except in the case of tensile elongation which was somewhat lower. Attempts to explain the differences in terms of microstructural observations were only partially successful. DOE

N86-11230*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
INVESTIGATION OF LOW-TEMPERATURE SOLDERS FOR CRYOGENIC WIND TUNNEL MODELS Interim Report
George C. Firth and Vernon E. Watkins, Jr. *In its* Welding, Bonding and Fastening, 1984 Sep. 1985 p 21-34 refs (For primary document see N86-11227 02-23)
Avail: NTIS HC A21/MF A01 CSCL 11F

N86-11231*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
NTF: SOLDERING TECHNOLOGY DEVELOPMENT FOR CRYOGENICS
E. Thomas Hall, Jr. *In its* Welding, Bonding and Fastening, 1984 Sep. 1985 p 35-54 refs (For primary document see N86-11227 02-23)
Avail: NTIS HC A21/MF A01 CSCL 11F

N86-11873# Sandia Labs., Albuquerque, N. Mex. Analytical Solid Mechanics Div.
APPLICATION OF A MIXTURE THEORY TO THE BINARY ALLOY SOLIDIFICATION PROBLEM Abstract Only
Vincent C. Prantil *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 27 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N86-11339*# College of William and Mary, Williamsburg, Va. Dept. of Chemistry.
CHARACTERIZATION OF THE RELATIONSHIP OF THE CURE CYCLE CHEMISTRY TO CURE CYCLE PROCESSING PROPERTIES Report, period ending 31 Jul. 1985
David E. Kranbuehl 23 Aug. 1985 33 p refs
(Grant NAG1-237)
(NASA-CR-176256; NAS 1.26:176256) Avail: NTIS HC A03/MF A01 CSCL 11B

Dynamic dielectric analysis (DDA) is used to study curing polymer systems and thermoplastics. Measurements are made over a frequency range of six decades. This wide range of frequencies increases the amount of information which can be obtained. The data is analyzed in terms of the frequency dependence of the complex permittivity epsilon sup *, specific conductivity sigma (ohm/cm) and the relaxation time tau, parameters which are characteristic of the cure state of the material and independent of the size of the sample. Author

N86-11340*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
STRENGTH AND FLEXIBILITY PROPERTIES OF ADVANCED CERAMIC FABRICS
Paul M. Sawko and Huy Kim Tran (San Jose State Univ.) Sep. 1985 24 p refs
(NASA-TM-86824; Rept-85279; NAS 1.15:86824) Avail: NTIS HC A02/MF A01 CSCL 11B

The mechanical properties of four advanced ceramic fabrics are measured at a temperature range of 23 C to 1200 C. The fabrics evaluated are silica, high-and low-boria content aluminoborosilicate, and silicon carbide. Properties studied include fabric break strengths from room temperature to 1200 C, and bending durability after temperature conditioning at 1200 C and 1400 C. The interaction of the fabric and ceramic insulation is also studied for shrinkage, appearance, bend resistance, and fabric-to-insulation bonding. Based on these tests, the low-boria content aluminoborosilicate fabric retains more strength and fabric durability than the other fabrics studied at high temperature. Author

N86-11341# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
CORROSION-PREVENTIVE PRIMERS FOR MILITARY EQUIPMENT Final Report
S. J. Spadafora, C. R. Hegedus, and D. F. Pulley 1 Apr. 1985 30 p
(NR Proj. F61-542)
(AD-A156927; NADC-85029-60) Avail: NTIS HC A03/MF A01 CSCL 11/3

The operational readiness and life-time of military equipment can be significantly reduced by corrosion. One way of protecting equipment against this process is through the use of corrosion-preventive primers. These primers are composed of a variety of resins, pigments and solvents to produce materials with different properties to cover a broad range of operational environments. Eleven primers conforming to military and federal specifications were tested on steel and aluminum specimens. Properties such as corrosion protection, adhesion, flexibility and chemical resistance were determined for each primer. The results of this evaluation indicate a wide variety of performance properties for the eleven primers. This information is presented to enable the reader to choose a material with the most appropriate properties for a specific use. Author (GRA)

N86-11342# Naval Academy, Annapolis, Md. Dept. of Physics.
ELECTRICAL RELAXATION IN POLY(ETHYLENE OXIDE) Interim Technical Report
J. J. Fontanella and M. C. Wintergill Jun. 1985 27 p
(Contract N00014-85-F-0001)
(AD-A157301; TR-16) Avail: NTIS HC A03/MF A01 CSCL 07/4

Audio frequency complex admittance (DR) has been used to investigate electrical relaxation in poly(ethylene oxide) (PEO). The complex admittance measurements were performed at seventeen frequencies from 10 to 100,000 Hz in approprimately equal logarithmic intervals using a fully automated dielectric spectrometer and measurements were performed in vacuum over the temperature range 5.5 to 350K. Two relaxations are observed at low temperatures which is consistent with the literature. In order to gain new information concerning the gamma relaxation, measurements were made at -94, -91, and -88 C at pressures up to 0.2 GPa. The shift in the peak frequency with pressure and hence, the activation volume are found to be extremely small. This result combined with other work implies that the relaxation is associated with the motion of very small segments of the polymer chain. GRA

N86-11343# Dayton Univ., Ohio.
STUDIES ON CHALCOGENIDE FILMS Final Report, 1 Feb. 1984 - 31 Jan. 1985
B. Kumar and K. White May 1985 33 p
(Contract F33615-82-C-5001)
(AD-A157340; UDR-TR-85-32; AFWAL-TR-85-4046) Avail: NTIS HC A03/MF A01 CSCL 11/2

Three research tasks related to chalcogenide films have been studied. The first task deals with the thermal sensitivity of reflection peaks of narrow band reflection filters. It has been shown that a significant shift in the reflection peak can be expected in the reflection filters due to a change in temperature. The shift could be minimized by modifying film compositions. The dn/dT (Temperature coefficient of refractive index) has been identified as an important factor of the thermal sensitivity parameters. It has been suggested that in addition to bulk composition, impurities play and important role in determining the dn/dT. The second task reports the experimental data and discussion related to the effects of aging on the refractive index of As2S3 films. It has been shown that the refractive index increases by approximately 4% due to an aging below the glass transition temperature. The third task evaluates a relationship between the deposition rate and stoichiometry of As2S3 films. It has been observed that as the deposition rate increases, the films become sulfur deficient. GRA

N86-11344# Ohio State Univ., Columbus.
STUDIES ON THE SYNTHESES OF BORON HYDRIDE SYSTEMS Final Report, 1 Apr. 1982 - 31 Mar. 1985
S. G. Shore 25 May 1985 20 p
(Contract DAAG29-82-K-0112)
(AD-A157368; ARO-19129.5-CH) Avail: NTIS HC A02/MF A01 CSCL 07/2

Over the past three years, the principal objective of this program has been to fully develop and to extend earlier work on the conversion of pentaborane(9), B5H9, to potentially useful higher boron hydride systems. The existence of a large quantity of B5H9 in U.S. government storage provided the impetus for this work. On the whole, this objective has been achieved. Achieved were significant improvements over an earlier synthesis of decarborane (14), B10H14, both from the stand point of yield and safety. Furthermore, it has been demonstrated that B5H9 can be converted to a number of higher boron hydride species through one-pot procedures which give yields of products, in general, equivalent to or better than obtained by other methods. Thus, B5H9 in storage is a potential feedstock for these materials. In addition to these above efforts, during the grant period studies of the general chemistry of boron hydride were undertaken and report some interesting new developments are reported. GRA

N86-11345# Cincinnati Univ., Ohio. Dept. of Materials Science and Metallurgical Engineering.
COMPATIBILIZING EFFECT OF RANDOM OR BLOCK COPOLYMER ADDED TO BINARY MIXTURE OF HOMOPOLYMERS
D. Rigby, J. L. Lin, and R. J. Roe 1 Aug. 1985 29 p
(Contract N00014-85-K-0245)
(AD-A157384; TR-1) Avail: NTIS HC A03/MF A01 CSCL 11/9

When copolymer A-B is added to the mixture of homopolymer A and homopolymer B, the compatibility between the two homopolymers is enhanced under certain conditions. Analysis, based on the Flory-Huggins free energy of mixing, gives the specific conditions under which the critical, spinodal or binodal temperature of the ternary mixture is expected to be lowered linearly with the amount of the added copolymer. Experimental measurements were performed on the changes in the cloud point of the mixtures of polystyrene and polybutadiene to which varying amounts of styrene/butadiene random or diblock copolymer were added. The results agree with the theoretical expectation. From quantitative analysis of the cloud point depression, the temperature coefficient of the interaction energy density between styrene and butadiene polymers is determined. The temperature coefficient is found to give an excellent agreement with the value previously determined by a curve fitting procedure applied to the cloud point curves of binary mixtures. GRA

N86-11346# Cornell Univ., Ithaca, N.Y. Dept. of Materials Science and Engineering.
PROPERTIES OF CRAZES AND DEFORMATION ZONES IN GLASSY POLYMERS Final Report, 1976 - 1985
E. J. Kramer May 1985 17 p
(Contracts DAAG29-82-K-0092; DAAG29-79-C-0015; Grant DAAG29-76-G-0103)
(AD-A157428; ARO-12636.10-MS; ARO-18701.2-MS; ARO-16123.21-MS) Avail: NTIS HC A02/MF A01 CSCL 11/9

New experimental methods, holographic interferometry and quantitative transmission electron microscopy, have been developed to investigate the microstructure, mechanical properties and failure of crazes and deformation zones DZ's in glassy polymers. Plasticizaton by the environment is found to be the major factor in environmental crazing and cracking. Air crazing, and the transition to more ductile DZ behavior, is controlled largely by the entanglement density of the polymer glass. Low entanglement density polymer craze readily and the craze fibrils break down rapidly to form cracks. High entanglement density polymers preferentially form non-fibrillated DZ's; crazes when formed are more resistant to craze breakdown in these polymers. A comprehensive model of these entanglement effects has been developed which explain the natural extension ratios of crazes and DZ's, the craze to DZ transition and the craze fibril stability. GRA

N86-11347# Naval Research Lab., Washington, D. C.
DEVELOPMENT OF CASTOR-OIL-RESISTANT POLYURETHANE SONAR ENCAPSULANTS Final Report, Sep. 1981 - Aug. 1982
W. T. Maurice and C. M. Thompson 30 Jun. 1985 45 p
(AD-A157576; NRL-MR-5578) Avail: NTIS HC A03/MF A01 CSCL 11/9

Polyurethanes have been widely used as underwater acoustic encapsulants for over twenty years. This research was designed to produce a polyurethane encapsulant that is nonhazardous and non-proprietary for use in castor-oil-filled systems. Seven commercial diamines were evaluated as replacements for methylene bis(2-chloroaniline)(MBOCA) in the cure system. The polyurethane produced were screened according to their handling properties, strength, modulus retention on water and castor oil exposure, electrical properties, and sound speed. The final candidates are commercial Toluene Diisocyanate/ Polyoxytetramethylene glycol prepolymers cured with diamine/diol/catalyst system. The resulting polyurethanes exhibit better combined castor oil and water resistance than any commerically available material. GRA

N86-11348# Sandia Labs., Albuquerque, N. Mex.
PHOTOSENSITIVITY AND IMAGING CHARACTERISTICS OF ION-IMPLANTED PLZT CERAMICS
C. E. Land 1985 21 p Presented at the 6thIntern. Meeting on Ferroelec., Kobe, Japan, 12 Aug. 1985
(Contract DE-AC04-76DP-00789)
(DE85-015489; SAND-85-0435C; CONF-850880-2) Avail: NTIS HC A02/MF A01

It was reported in previous papers that both the near-UV and the visible photosensitivities of ferroelectric-phase PLZT (lead lanthanum zirconate titanate) ceramics are increased by as much as four orders of magnitude by ion implantation or a combination of thermal diffusion of Al and ion implantation. New results are presented here on high-energy (1 MeV) implants of Al and Ni and complaints of Al + Ne and Ni + Ne, and these results are compared with earlier 500 keV implants of Al and Cr and compliants of Al + Ne and Cr + Ne as surface modification techniques for increasing the visible photosensitivity of PLZT. The important role of grain size in determining optimum contrast and resolution of stored optical information is described in terms of new experimental results. DOE

N86-11349# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
SOLID-MELT INTERFACE STUDIES OF HIGH-SPEED SILICON SHEET GROWTH
T. F. Ciszek Feb. 1985 67 p
(Contract DE-AC02-83CH-10098)
(DE85-008783; SERI/PR-212-2634) Avail: NTIS HC A04/MF A01

Radial growth-rate anisotropies and limiting growth forms of point-nucleated, dislocation-free silicon sheets spreading horizontally on the free surface of a silicon melt have been measured for (100), (110), (111), and (112) sheet planes. Analysis of the sheet

edges leads to predicted geometries for the tip shape of unidirectional, dislocation-free, horizontally growing sheets propagating in arious directions within the above-mentioned planes. Feasibility is demonstrated for a crucible-free horizontal (CFH) ribbon growth method. High-purity, cold-crucible melt confinement is used to grow silicon sheets by edge-supported pulling (ESP). Quartz capillary filaments are used. Solar cell data on these sheets are presented. Also cell, lifetime, mobility, spreading resistance, X-ray topography, and neutron activation analysis data are obtained for dislocation-free cylindrical ingots of [111] and [100] orientation. X-ray topography analysis of dendritic web silicon sheets is conducted and the resultant topographs are presented in this report. A possible correlation between slip dislocations and web cell efficiency is seen. Float zoning studies are initiated for high-purity, dislocation-free silicon to be applied to high-efficiency silicon solar cells. DOE

N86-11350# California Univ., Livermore. Lawrence Livermore Lab.
PULSE DURATION DEPENDENCE OF 1064-nm LASER DAMAGE THRESHOLDS OF POROUS SILICA ANTIREFLECTION COATINGS ON FUSED SILICA SUBSTRATES
D. Milam, I. M. Thomas, C. Weinzapfel, and J. G. Wilder 30 May 1985 15 p refs Presented at the Boulder Damage Symp., Boulder, Colo., 15 Oct. 1985
(Contract W-7405-eng-48)
(DE85-013207; UCRL-91429; CONF-8410276-1) Avail: NTIS HC A02/MF A01

Researchers used 1064-nm pulses with durations of 1, 5, 9 ns to measure laser-damage thresholds of 10 porous silica antireflection coatings deposited from both methanol and ethanol solutions containing silica particles with diameters of 10 to 20 nm. The median thresholds measured at the three pulse durations, 10.8 J/cm(2), 26.5 J/cm(2), and 38 J/cm(2), scaled as pulse duration to the 0.56 power. DOE

N86-11351# Argonne National Lab., Ill.
CORRELATIONS OF CHEMICAL, MICROSTRUCTURAL AND MECHANICAL PROPERTIES OF POLYETHYLENE PIPING MATERIALS
L. A. Raphaelian and D. G. Ettinger 1985 8 p Presented at the 5th Ann. Plastic Piping Mater. Workshop, Rosemont, Ill., 19 Jun. 1985
(Contract W-31-109-eng-38)
(DE85-013077; CONF-8506122-1) Avail: NTIS HC A02/MF A01

A variety of analyses, including carbon-13 nuclear magnetic resonance ((13)C NMR), X-ray diffraction (XRD), and gas chromatography/mass spectrometry (GC/MS), were performed on several commercial polyethylene (PE) pipes. In many cases, not only the sample as a whole but also the inner surface, bulk, and outer surface were examined. Also, certain samples were examined before and after annealing. Correlations of the data from the analyses with data from Constant Tensile Load Tests (CTLT) of the commercial pipe samples were developed. DOE

N86-11352# Mound Lab., Miamisburg, Ohio.
PHYSICAL PROPERTY CHANGES OF A LITHIA-ALUMINA-SILICA BASED GLASS AS A FUNCTION OF COMPOSITION
D. P. Kramer, G. L. Harville, D. A. Buckner, J. P. McCarthy, A. B. Nease, and D. B. Sullenger 22 Jul. 1985 41 p
(Contract DE-AC04-76DP-00053)
(DE85-015610; MLM-3272) Avail: NTIS HC A03/MF A01

The effect of compositional changes on various physical properties (coefficient of thermal expansion, crystalline phases, and refractive index) both before and after devitrification (when appropriate) on a lithia alumina silica based glass is determined. The results obtained by adding or subtracting various amounts of the compositional oxides (lithium carbonate, potassium carbonate, ammonium phosphate, alumina, boric acid, or silica) one at a time shows that compositional changes have a pronounced influence on the resultant physical properties of these glasses. DOE

N86-11353# California Univ., Livermore. Lawrence Livermore Lab.
CRYSTAL CLASS AND THE ELECTROOPTIC EFFECT
D. Eimerl May 1985 22 p
(Contract W-7405-eng-48)
(DE85-015240; UCRL-53636) Avail: NTIS HC A02/MF A01

The propagation of light in linear electrooptic media is reviewed with emphasis on understanding the full effect of crystal symmetry. The changes in the refractive indexes and the rotation of the optic axes are calculated in detail for each of the 18 biaxial and uniaxial crystal classes. The direction of the applied field and the ray propagation are unrestricted. Under these circumstances, there is no apparent reason to prefer crystals from any particular class. However, in applications requiring large aperture electrooptic devices, there is an advantage to applying the field parallel to the ray direction. Then the most attractive crystal classes are m, mm2, 4, 4mm, 4, 42n, 23, 43n, 6, and 6mm. These crystal classes allow propagation along an optic axis, generate birefringence with the applied field parallel to the optic axis and ray direction, and are incapable of rotating the index ellipsoid. Materials from these classes will provide robust electrooptic switches at large aperture. DOE

N86-11354# Sandia Labs., Albuquerque, N. Mex.
TRANSPORTATION SYSTEM IMPACT LIMITER DESIGN USING RIGID POLYURETHANE FOAM
G. W. Wellman Jun. 1985 48 p refs
(Contract DE-AC03-76DP-00789)
(DE85-015088; SAND-84-2271; TTC-0532) Avail: NTIS HC A03/MF A01

Techniques used to apply the finite element method to the analysis of rigid polyurethane foam that is confined by a thin, ductile metallic skin were investigated. The initial investigation covered the analysis of a simple geometry and loading condition of constrained and unconstrained foam using the constitutive relationships implied in the Elastic-Plastic and Crushable Foam material models in HONDO 2 and DYNA2D/3D. The final investigation consisted of the analysis of a series of tests of scale model impact limiters and comparison of the experimental and analytical results. DOE

N86-11355# Sandia Labs., Albuquerque, N. Mex.
POLYURETHANE FOAM COMPONENT LIFETIMES
K. B. Wischmann 1985 6 p Presented at the 190th Am. Chem. Soc. Natl. Meeting, Chicago, 8 Sep. 1985
(Contract DE-AC04-76DP-00789)
(DE85-008206; SAND-84-2239C; CONF-850942-1) Avail: NTIS HC A02/MF A01

Access deterrent foams are generated by mixing two separately stored and pressurized components upon demand. Investigations have been conducted concerning the aging of both components of three separate polyurethane foam formulations. The polyol component of the first formulation, a propylene oxide adduct of phosphoric acid, hydrolyzes rapidly to give phosphoric acid. Since phosphoric acid can corrode the container as well as adversely affect the final foam properties, a second formulation not containing acid adduct is investigated. This second polyol is isothermally aged at room temperature, 60 C and 71 C and reactions follow by acid number determination. A reaction between the polyol and the blowing agent, Freon 11, is found to give high acid content. Attempts to add inhibitors to lengthen this initiation period fails. Finally, a third formulation is designed which places the Freon 11 in the isocyanate component thereby precluding the incompatibility of the blowing agent with the polyol. subsequent aging studies indicate a long term (6 to 8 years) storage foam system could be achieved. DOE

N86-11356# Aerospace Corp., El Segundo, Calif. Lab. Operations.
IMPURITY MONITORING BY LASER-INDUCED FLUORESCENCE TECHNIQUES
J. A. Gelbwachs 26 Dec. 1984 29 p
(Contract DE-AT03-76ER-71013)

(DE85-014142; ATR-84(7783)-4) Avail: NTIS HC A03/MF A01

Laser-induced fluorescence spectroscopy can provide a highly sensitive and selective means of detecting atomic and ionic impurities. Because the photodetector can be physically isolated from the laser-excited region, these techniques can be applied to monitoring in hostile environments. The basic concepts behind fluorescence detection are reviewed. Saturated optical excitation is shown to maximize impurity atom emission yield while mitigating effects of laser intensity fluctuations upon absolute density calibration. Monitoring in high- and low-pressure monitoring environments is compared. Methods to improve detection sensitivity by luminescence background suppression are presented. DOE

N86-11357# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.

POLYMER GLAZINGS FOR SILVER MIRRORS

H. H. Neidlinger and P. Schissel Jul. 1985 11 p refs Presented at the SPIE Intern. Tech. Symp. on Opt. and Electro-Opt. Engrs., San Diego, Calif., 18 Aug. 1985

(Contract DE-AC02-83CH-10093)

(DE85-012140; SERI/TP-255-2724; CONF-850887-3) Avail: NTIS HC A02/MF A01

This paper reports on an evaluation and modification of polymeric glazings to protect silver mirrors. The mirrors were made using Corning 7809 glass as a substrate onto which a thin silver film is deposited. The modified polymeric films are then cast from solution onto the silver. The mirrors were characterized by measuring the hemispherical reflectance and the specular reflectance at 660 nm and selected acceptance angles (7.5 mrad or 3.5 mrad). The mirrors were exposed to environmental degradation using accelerated weathering devices and outdoor exposure. Empirical evidence has demonstrated that polymethylmethacrylate is a stable polymer in a terrestrial environment, but the polymer does not provide adequate protection for the silver reflector. The crucial role in degradation played by ultraviolet (UV) light is shown by several experimental results. It has been demonstrated that UV stabilizers added to the polymer improve the weatherability of mirrors. DOE

N86-11249*# Lockheed-Georgia Co., Marietta.

ADHESIVES FOR AEROSPACE

L. E. Meade *In* NASA. Langley Research Center Welding, Bonding and Fastening, 1984 Sep. 1985 p 339-349 refs (For primary document see N86-11227 02-23)

Avail: NTIS HC A21/MF A01 CSCL 11A

N86-11250*# Boeing Aerospace Co., Seattle, Wash.

HIGH-TEMPERATURE ADHESIVE DEVELOPMENT AND EVALUATION

Cari L. Hendricks and Jeremy N. Hale *In* NASA. Langley Research Center Welding, Bonding and Fastening, 1984 Sep. 1985 p 351-370 refs (For primary document see N86-11227 02-23)

Avail: NTIS HC A21/MF A01 CSCL 11A

N86-11251*# Martin Marietta Corp., Baltimore, Md.

USE OF HYDRATION INHIBITORS TO IMPROVE BOND DURABILITY OF ALUMINUM ADHESIVE JOINTS

G. D. Davis, J. S. Ahearn, L. J. Matienzo, and J. D. Venables *In* NASA. Langley Research Center Welding, Bonding and Fastening, 1984 Sep. 1985 p 371-396 refs Previously announced in IAA as A85-29979 (For primary document see N86-11227 02-23)

(Contract N00014-80-C-0718)

Avail: NTIS HC A21/MF A01 CSCL 11A

N86-11252*# United Technologies Research Center, East Hartford, Conn.

FACTORS AFFECTING THE PROCESSING OF EPOXY FILM ADHESIVES

R. A. Pike *In* NASA. Langley Research Center Welding, Bonding and Fastening, 1984 Sep. 1985 p 397-416 refs (For primary document see N86-11227 02-23)

Avail: NTIS HC A21/MF A01 CSCL 11A

N86-11254*# Naval Surface Weapons Center, White Oak, Md.

REDUCTION OF MOISTURE EFFECTS DURING THE CURE OF EPOXY ADHESIVES USED IN COMPOSITE REPAIR

Joseph M. Augl and George T. Sivy *In* NASA. Langley Research Center Welding, Bonding and Fastening, 1984 Sep. 1985 p 439-463 ref (For primary document see N86-11227 02-23)

Avail: NTIS HC A21/MF A01 CSCL 11A

N86-11263*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PMR POLYIMIDES FROM SOLUTIONS CONTAINING MIXED ENDCAPS

Peter Delvigs *In its* High Temp. Polymer Matrix Composites Sep. 1985 p 23-34 refs (For primary document see N86-11260 02-24)

Avail: NTIS HC A18/MF A01 CSCL 11B

N86-11265*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

BISMALEIMIDES AND RELATED MALEIMIDO POLYMERS AS MATRIX RESINS

John A. Parker, Demitrius A. Kourtides, and George M. Fohlen *In* NASA. Lewis Research Center High Temp. Polymer Matrix Composites Sep. 1985 p 55-77 refs (For primary document see N86-11260 02-24)

Avail: NTIS HC A18/MF A01 CSCL 11B

N86-11266*# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Chemistry.

THE SYNTHESIS, CHARACTERIZATION AND THERMAL CHEMISTRY OF MODIFIED NORBORNENYL PMR ENDCAPS

Chaim N. Sukenik, William M. Ritchey, Vinay Malhotra, and Uday Varde *In* NASA. Lewis Research Center High Temp. Polymer Matrix Composites Sep. 1985 p 79-90 refs (For primary document see N86-11260 02-24)

(Grant NAG3-163)

Avail: NTIS HC A18/MF A01 CSCL 11B

N86-11267*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ALL-AROMATIC BIPHENYLENE END-CAPPED POLYQUINOLINE AND POLYIMIDE MATRIX RESINS

John P. Droske (Colorado State Univ.), John K. Stille (Colorado State Univ.), and William B. Alston *In its* High Temp. Polymer Matrix Composites Sep. 1985 p 91-95 refs (For primary document see N86-11260 02-24)

Avail: NTIS HC A18/MF A01 CSCL 11B

N86-11268*# Boeing Aerospace Co., Seattle, Wash.

EVALUATION OF A HIGH TEMPERATURE ADHESIVE FOR FABRICATING GRAPHITE/PMR-15 POLYIMIDE STRUCTURES

S. G. Hill and J. B. Cushman *In* NASA. Lewis Research Center High Temp. Polymer Matrix Composites Sep. 1985 p 97-108 refs (For primary document see N86-11260 02-24)

Avail: NTIS HC A18/MF A01 CSCL 11A

N86-11269*# Dexter Corp., Pittsburg, Calif. Hyson Div.

NEW PROCESSABLE MODIFIED POLYIMIDE RESINS FOR ADHESIVE AND MATRIX APPLICATIONS

David Landman *In* NASA. Lewis Research Center High Temp. Polymer Matrix Composites Sep. 1985 p 109-123 refs (For primary document see N86-11260 02-24)

Avail: NTIS HC A18/MF A01 CSCL 11B

N86-11270*# American Cyanamid Co., Stamford, Conn. Chemical Research Div.

RECENT DEVELOPMENTS IN POLYIMIDE AND BISMALEIMIDE ADHESIVES

Robert E. Politi *In* NASA. Lewis Research Center High Temp. Polymer Matrix Composites Sep. 1985 p 125-136 (For primary document see N86-11260 02-24)

Avail: NTIS HC A18/MF A01 CSCL 11B

N86-11271*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CHEMICAL CONTROL OF RATE AND ONSET TEMPERATURE OF NADIMIDE POLYMERIZATION
Richard W. Lauver *In its* High Temp. Polymer Matrix Composites Sep. 1985 p 137-149 refs (For primary document see N86-11260 02-24)
Avail: NTIS HC A18/MF A01 CSCL 11B

N86-11275*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
REPLACEMENT OF MDA WITH MORE OXIDATIVELY STABLE DIAMINES IN PMR-POLYIMIDES
William B. Alston *In its* High Temp. Polymer Matrix Composites Sep. 1985 p 187-205 refs (For primary document see N86-11260 02-24)
Avail: NTIS HC A18/MF A01 CSCL 11B

N86-11288*# Tribon Bearing Co., Cleveland, Ohio.
TRANSFER MOLDING OF PMR-15 POLYIMIDE RESIN
J. P. Reardon, D. W. Moyer, and B. E. Nowak *In* NASA. Lewis Research Center High Temp. Polymer Matrix Composites Sep. 1985 p 379-392 refs (For primary document see N86-11260 02-24)
Avail: NTIS HC A18/MF A01 CSCL 11B

N86-11532# Yarmouk Univ., Irbid (Jordan). Dept. of Mechanical Engineering.
STIFFNESS AND DAMPING COEFFICIENTS OF RUBBER
M. Issa Abdulhadi *In* The Shock and Vibration Information Center Shock and Vibration Digest, Vol. 17, No. 5 May 1985 p 3-9 refs (For primary document see N86-11531 02-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 11/10

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N86-11358# Naval Postgraduate School, Monterey, Calif.
AN INVESTIGATION OF THE EFFECTS OF FUEL COMPOSITION ON COMBUSTION CHARACTERISTICS IN A T-63 COMBUSTOR Progress Report, Oct. 1983 - Mar. 1985
R. W. Dubeau, P. J. Hickey, A. C. Krug, A. L. Lohman, and J. P. Weller Mar. 1985 89 p
(AD-A157325; NPS67-85-004) Avail: NTIS HC A05/MF A01 CSCL 21/4

A T63 combustor was instrumented to allow measurement of center line distributions of temperature and soot size and concentration using water-cooled probes. Three-wavelength light transmission measurements were also made at two locations to determine that mean soot size and NOx concentrations were measured in the exhaust duct. Five fuels of varying composition were used in the combustor and initial tests were conducted using two smoke-suppressant fuel additives. The data indicated that the aft region of the combustor contained a large, low temperature recirculation zone, surrounded by an annular region of higher temperature and lower soot concentration. Light transmissionn measurements appeared to yield reasonable particle size data when compared to collected samples. However, the extent of agglomeration in the collection probes was unknown. Smoke-suppressant fuel additives were found to have reduced effectiveness in the present test series, apparently due to unheated inlet air which was employed. NOx levels increased significantly with increasing combustor exhaust temperature (or fuel-air ratio). Soot concentration increased and transmittance decreased with increasing fuel-air ratio. The mean soot particle size was found to be between 0.21 and 0.26 microns, independent of fuel composition and fuel-air ratio. GRA

N86-11359# Sandia Labs., Albuquerque, N. Mex.
SHOCK-INDUCED TEMPERATURE DISTRIBUTIONS IN POWDER COMPACT RECOVERY FIXTURES
R. A. Graham and D. M. Webb 1985 7 p refs Presented at the Am. Phys. Soc. Topical Conf. on Shock Waves in Condensed Matter, Spokane, 22 Jul. 1985
(Contract DE-AC04-76DP-00789)
(DE85-015139; SAND-85-0334C; CONF-850736-28) Avail: NTIS HC A02/MF A01

Sandia Bear and Bertha powder compact recovery fixture systems for explosive loading have been widely used to preserve powder compact samples for post-shock analysis. Shock conditions within the compacts are determined from an extensive program of numerical simulation which reveals that, even though the initial loading is planar, the sample conditions are controlled by a radial-mode compression. The wave-trapping phenomenon which occurs in the powder samples leads to relatively uniform shock-induced temperatures except for a very hot area in the outer edge region of some fixtures. DOE

N86-11360# New Mexico Inst. of Mining and Technology, Socorro.
SHOCK CONSOLIDATION OF IN-100 NICKEL-BASE SUPERALLOY POWDER
S. I. Wang, M. A. Meyers, and R. A. Graham 1985 5 p refs Presented at the Am. Phys. Soc. Topical Conf. on Shock Waves in Condensed Matter, Spokane, 22 Jul. 1985 Prepared in cooperation with Sandia National Labs., Albuquerque, N. Mex.
(Contract DE-AC04-76DP-00789)
(DE85-015159; SAND-85-1597C; CONF-850736-36) Avail: NTIS HC A02/MF A01

Shock consolidation of IN-100 powders was studied in Sandia Bear and Bertha fixtures over a pressure from 7.5 to 27 GPa. In addition, the influence of pulse duration from 4.5 to 19 (MU)s was investigated at 16 GPa. From the metallographic observations it was established that: (1) the mean pressure for bonding, with approx. 5% interparticle melting, is about 20 GPa; (2) the pulse duration seems to play a role in the consolidation; and (3) the stock temperature is an important parameter. It significantly enhances interparticle melting. DOE

N86-11361# Los Alamos National Lab., N. Mex.
DETONATION REACTION ZONE STUDIES ON TATB EXPLOSIVES
W. L. Seitz, H. L. Stacy, and J. Wackerle 1985 11 p refs Presented at the 8th Intern. Symp. on Detonation, Albuquerque, N. Mex., 15 Jul. 1985
(Contract W-7405-eng-36)
(DE85-015710; LA-UR-85-2460; CONF-850706-28) Avail: NTIS HC A02/MF A01

Interface velocity histories between heterogeneous detonating explosives and transparent windows, separated by a thin (13 (micron)m) aluminum shim, have been obtained with an image-intensified rotating-mirror streak camera and a Fabry-Perot velocity interferometer system. Seven TATB-based explosives were studied with PMMA windows for typically three charge lengths. Two of the explosives were also studied with LiF windows. In each case a non-steady detonation was observed, with each increasing charge length showing a corresponding increase in the interface velocity histories. Time resolution and velocity error are estimated to be about 6 ns and 2%, respectively. Numerical simulations for one of the explosives, for which a shock-strength modified Arrhenius rate law (DAGMAR) and an assumed equation of state (HOM) had been previously calibrated with shock initiation gauge data, gave good agreement with the experimental velocity histories. DOE

N86-11966# Joint Publications Research Service, Arlington, Va.
STEADY-STATE DETONATION OF CHARGES OF FINITE LENGTH Abstract Only
V. K. Ashayev, G. S. Doronin, and V. S. Zhuchenko *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 37 refs Transl. into ENGLISH from Fiz. Goreniya i Vzryva (Novosibirsk, USSR), v. 21, no. 1, Jan. - Feb. 1985 p 127-130 (For primary

document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

N86-11924# Joint Publications Research Service, Arlington, Va.
PRESSURE-COUPLED RESPONSE FUNCTION OF SOLID PROPELLANTS INCLUDING THOSE WITH NEGATIVE PRESSURE-EXPONENTS Abstract Only
Wengan Xu *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-014) 2 May 1985 p 76 Transl. into ENGLISH from Yuhang Xuebao (Beijing), no. 1, 31 Jan. 1985 p 47-58 Original language document announced in IAA as A85-42780 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N86-11362# New Mexico Univ., Albuquerque. Engineering Research Inst.
VALIDATION OF PROCEDURES FOR PAVEMENT DESIGN ON EXPANSIVE SOILS Final Report, May 1984 - Aug. 1985
R. Gordon McKeen Washington FAA Jul. 1985 99 p refs (Contract F29601-84-C-0080)
(FAA-PM-85-15; NMERI-WA5-4(5.02)) Avail: NTIS HC A05/MF A01

This report documents site investigations and design recommendations for airport pavements on expansive soils at three sites. The methods used were developed previously in an FAA-sponsored research project. The design procedure involves soil characterization, determination of surface characteristics and evaluation of soil-pavement interaction. Investigations at three airports are reported; they are Murdo, South Dakota, Mesquite, Texas, and Love Field, Dallas, Texas. Soils data are used along with climatic information to obtain estimates of the equivalent thickness of pavement required for each site. The work at Love Field was somewhat different than the other sites since NMERI was not directly conducting the investigation. Results are reported in the form of pavement thickness required to adequately perform, in terms of surface roughness, on the soil surface characteristics predicted for each site. Recommendations are included for consideration in rehabilitation of each site since all were experiencing surface roughness at the time of the investigations. These results confirm that methods developed for evaluating airport pavements on expansive soils provide useful information for pavement design. B.W.

N86-11363# National Bureau of Standards, Gaithersburg, Md.
APPLIED MODEL VALIDATION Progress Report
Alan D. Davies Jul. 1985 31 p refs
(NBSIR-85-3154-1) Avail: NTIS HC A03/MF A01

The NBS Center for Fire Research (CFR) conducts scientific research bearing on the fire safety of buildings, vehicles, tunnels and other inhabited structures. Data from controlled fire experiments are collected, analyzed and reduced to the analytical formulas that appear to underly the observed phenomena. These results and more general physical principles are then combined into models to predict the development of environments that may be hostile to humans. This is a progress report of an applied model validation case study. The subject model is Transport of Fire, Smoke and Gases (FAST). Products from a fire in a burn room exit through a connected corridor to outdoors. Cooler counterflow air in a lower layer feeds the fire. The model predicts corridor layer temperatures and thicknesses vs. time, given enclosure, fire and ambient specifications. Data have been collected from 38 tests using several fire sizes, but have not been reduced. Corresponding model results, and model and test documentation are yet to come. Considerable modeling and calculation is needed to convert instrument readings to test results comparable with model outputs so that residual differences may be determined. B.W.

N86-11364# National Bureau of Standards, Gaithersburg, Md.
FIRE GROWTH IN COMBAT SHIPS
J. Quintiere, H. Baum, and R. Lawson Jun. 1985 99 p refs
(NBSIR-85/3159) Avail: NTIS HC A05/MF A01

A discussion of fire phenomenology pertaining to ships is presented. It draws a background from ship fires, combat ship construction characteristics and scientific knowledge developed for building fires. The immediate goal of this research is to assess the prospect of developing a deterministic (physics) model for ship fire growth as initiated by explosive weapon effects. A specific analysis of vented explosion flows is given as well as a procedure for computing fire growth phenomena from formulae. Author

N86-11365# National Bureau of Standards, Gaithersburg, Md.
METHODS TO CALCULATE THE RESPONSE TIME OF HEAT AND SMOKE DETECTORS INSTALLED BELOW LARGE UNOBSTRUCTED CEILINGS
David D. Evans and David W. Stroup Feb. 1985 49 p refs
(NBSIR-85/3167) Avail: NTIS HC A03/MF A01

Recently developed methods to calculate the time required for ceiling mounted heat and smoke detectors to respond to growing fires are reviewed. A computer program, that calculates activation times for both fixed temperatures and rate of rise heat detectors in response to fires that increase in heat release rate proportionally with the square of time from ignition is given. A separate method and corresponding program are provided to calculate response time for fires having arbitrary heat release rate histories. This method is based on quasi-steady ceiling layer gas flow assumptions. Assuming a constant proportionality between smoke and hat release from burning materials, a method is described to calculate smoke detector response time modeling the smoke detector as a low temperature heat detector in either of the two response time models. Author

N86-11366# National Bureau of Standards, Gaithersburg, Md.
RESPONSE BEHAVIOR OF HOT-WIRES AND FILMS TO FLOWS OF DIFFERENT GASES
William M. Pitts and Bernard J. McCaffrey Jul. 1985 123 p refs (Grant AFOSR ISSA-00005)
(NBSIR-85/3203) Avail: NTIS HC A06/MF A01

Measurements of the voltage output for hot wire and film anemometers placed in flows of nine different gases have been made as a function of flow velocity. It has been possible to correlate the measurements quite accurately by treating the data in terms of suitably defined Reynolds and Nusselt numbers. In order to obtain these correlations it has been necessary to consider and correct for the effects of probe end conduction losses, temperature dependencies of gas molecular properties, flow slip at the probe surfaces, and gas accommodation. With the exception of the results for helium (for which accommodation effects are strong), the most important correction is shown to be that for the different temperature dependencies of the gas molecular properties. This finding is contrasted with previous studies which have assumed that the largest effect among different gases was due to variations in the Prandtl number. The importance of the nature of the flow over the cylindrical devices to the heat transfer behavior is described. A previously unreported hysteresis in the heat transfer behavior for RE 44 has been characterized and attributed to the presence or absence of eddy shedding from the heated cylinder. Author

N86-11367*# National Bureau of Standards, Gaithersburg, Md.
PROCEEDINGS OF THE THIRD CRYOCOOLER CONFERENCE Final Report
Ray Radebaugh, Beverly Louie, and Sandy McCarthy May 1985 284 p refs Conf. held in Boulder, Colo., 17-18 Sep. 1984 Sponsored by NASA. Goddard Space Flight Center
(NASA-CR-176298; NAS 1.26:176298; PB85-233369; NBS-SP-698; LC-85-600544) Avail: NTIS MF A01; also available SOD HC $10.00 as 003-003-02662-0 CSCL 13B

Mechanical and non-mechanical types of small cryocoolers in the temperature range of 4 to 80 K are discussed. Applications of these small cryocoolers include the cooling of infrared detectors, cryopumps, small superconducting devices and magnets, and electronic devices. For individual titles, see N86-11368 through N86-11393.

N86-11368*# National Bureau of Standards, Boulder, Colo. Electromagnetic Technology Div.
DESIGN OF CRYOCOOLERS FOR MICROWATT SUPERCONDUCTING DEVICES
J. E. Zimmerman *In its* Proc. of the 3rd Cryocooler Conf. May 1985 p 2-9 refs (For primary document see N86-11367 02-31)
Avail: NTIS MF A01; SOD HC $10.00 as 003-003-02662-0 CSCL 13B

The primary applications of the cryocoolers are for cooling various Josephson devices such as SQUID magnetometers and amplifiers, voltage standards, and microwave mixers and detectors. The common feature of these devices is their extremely low inherent bias power requirement, of the order of 10/1 W per junction. This provides the possibility of designing compact, low-power cryocoolers for these applications. Several concepts were explored and a number of laboratory model cryocoolers were built. These include low-power nonmagnetic regenerative machines of the Stirling or Gifford-McMahon type, three or four-stage Joule-Thomson machines, liquid-helium dewars with integral small cryocoolers to reduce the evaporation rate, and liquid-helium dewars with integral continuously or intermittently operated small helium liquefiers to permit operation of cryogenic devices for indefinite time periods. E.A.K.

N86-11369*# Nihon Univ., Tokyo (Japan). Atomic Energy Research Inst.
RECENT CRYOCOOLER PROGRESS IN JAPAN
Yoichi Matsubara *In* NBS Proc. of the 3rd Cryocooler Conf. May 1985 p 10-19 refs (For primary document see N86-11367 02-31)
Avail: NTIS MF A01; SOD HC $10.00 as 003-003-02662-0 CSCL 13B

The progress of cryocoolers and related devices in Japan is reviewed. The Japanese National Railways has developed the light weight 4 K on-board refrigerators since 1977 as part of the MAGLEV train program. Superconducting and cryogenic fundamental technology was examined which included high performance cryocooler, magnetic refrigerator and superfluid refrigeration. Space cryogenics such as the cooling systems of IR-detectors was studied. Cryocooler for special applications such as cryopump, NMR-CT and JJ devices was investigated. Compact heat exchangers, high performance regenerators and reliable compressors are investigated as a critical component technology. E.A.K.

N86-11370*# Los Alamos National Lab., N. Mex.
MAGNETIC REFRIGERATION FOR LOW-TEMPERATURE APPLICATIONS
J. A. Barclay *In* NBS Proc. of the 3rd Cryocooler Conf. May 1985 p 20-32 refs Sponsored in part by NASA. Kennedy Space Center, DOE and DARPA (For primary document see N86-11367 02-31)
Avail: NTIS MF A01; SOD HC $10.00 as 003-003-02662-0 CSCL 13B

The application of refrigeration at low temperatures ranging from production of liquid helium for medical imaging systems to cooling of infrared sensors on surveillance satellites is discussed. Cooling below about 15 K with regenerative refrigerators is difficult because of the decreasing thermal mass of the regenerator compared to that of the working material. In order to overcome this difficulty with helium gas as the working material, a heat exchanger plus a Joule-Thomson or other exponder is used. Regenerative magnetic refrigerators with magnetic solids as the working material have the same regenerator problem as gas refrigerators. This problem provides motivation for the development of nonregenerative magnetic refrigerators that span approximately 1 K to approximately 0 K. Particular emphasis is placed on high reliability and high efficiency. Calculations indicate considerable promise in this area. The principles, the potential, the problems, and the progress towards development of successful 4 to 20 K magnetic refrigerators are discussed. E.A.K.

N86-11371*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
RECIPROCATING MAGNETIC REFRIGERATOR
Dean L. Johnson *In* NBS Proc. of the 3rd Cryocooler Conf. May 1985 p 33-41 refs (For primary document see N86-11367 02-31)
Avail: NTIS MF A01; SOD HC $10.00 as 003-003-02662-0 CSCL 13B

A 4 to 15 K magnetic refrigerator to test as an alternative to the Joule-Thomson circuit as the low temperature stage of a 4 to 300 K closed-cycle refrigerator was developed. The reciprocating magnetic refrigerator consists of two matrices of gadolinium gallium garnet spheres located in tandem on a single piston which alternately moves each matrix into a 7 telsa magnetic field. A separate helium gas circuit is used as the heat exchange mechanism for the low and the high temperature extremes of the magnetic refrigerator. Details of the design and results of the initial refrigerator component tests are presented. E.A.K.

N86-11372*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
IMPROVED HEAT SWITCH FOR GAS SORPTION COMPRESSOR
Chung K. Chan *In* NBS Proc. of the 3rd Cryocooler Conf. May 1985 p 42-52 refs (For primary document see N86-11367 02-31)
Avail: NTIS MF A01; SOD HC $10.00 as 003-003-02662-0 CSCL 13B

Thermal conductivities of the charcoal bed and the copper matrix for the gas adsorption compressor were measured by the concentric-cylinder method. The presence of the copper matrix in the charcoal bed enhanced the bed conductance by at least an order of magnitude. Thermal capacities of the adsorbent cell and the heat leaks to two compressor designs were measured by the transient method. The new gas adsorption compressor had a heat switch that could transfer eight times more heat than the previous one. The cycle time for the new prototype compressor is also improved by a factor of eight to within the minute range. E.A.K.

N86-11373*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Applied Mechanics Div.
HYDRIDE ABSORPTION REFRIGERATOR SYSTEM FOR TEN KELVIN AND BELOW
Jack A. Jones *In* NBS Proc. of the 3rd Cryocooler Conf. May 1985 p 53-64 refs (For primary document see N86-11367 02-31)
Avail: NTIS MF A01; SOD HC $10.00 as 003-003-02662-0 CSCL 13B

A very long-life, lightweight and efficient hydride absorption refrigerator system was built to operate at ten Kelvin and below. The system consists of four basic stages of refrigeration. The first stage is accomplished by an active refrigeration system. The second stage is operated by a hydride absorption system, wherein a heated hydride powder drives off high pressure hydrogen through a Joule-Thomson/heat exchanger expansion loop such that the hydrogen is partially liquefied. In the third stage, the vapor pressure over the collected liquid hydrogen is lowered by absorbing the hydrogen vapor onto a different low pressure, worn hydride. With a 1.7 torr partial pressure of hydrogen gas in the hydride, liquid hydrogen is solidified and sublimes at 10 K. Long-life adiabatic demagnetization refrigerators, helium desorption, or helium diaphragm compressors are used to cool to 4 K or below. It is shown that the hydride concepts provide an extremely efficient means of refrigeration to 10 K, and that an entire sorption refrigeration process can be accomplished solely by using low grade heat energy at about 150 C. Author

N86-11374*# General Pneumatics Corp., Scottsdale, Ariz.
CLASSIFICATION OF CRYOCOOLERS
G. Walker *In* NBS Proc. of the 3rd Cryocooler Conf. May 1985

p 65-70 refs (For primary document see N86-11367 02-31)
Avail: NTIS MF A01; SOD HC $10.00 as 003-003-02662-0 CSCL 13B

A great diversity of methods and mechanisms were devised to effect cryogenic refrigeration. The basic parameters and considerations affecting the selection of a particular system are reviewed. A classification scheme for mechanical cryocoolers is presented. An important distinguishing feature is the incorporation or not of a regenerative heat exchanger, of valves, and of the method for achieving a pressure variation. E.A.K.

N86-11375*# Zhejiang Univ. (China). Cryogenic Engineering Lab.
AN EXPERIMENTAL STUDY FOR A MINIATURE STIRLING REFRIGERATOR
Shimo Li, Guobang Chen, Zhixiu Huang, Fagao Zhang, Cuangji Cui (Beijing Univ., China), and Jiazhang Li (Beijing Univ., China) *In* NBS Proc. of the 3rd Cryocooler Conf. May 1985 p 71-79 refs (For primary document see N86-11367 02-31)
Avail: NTIS MF A01; SOD HC $10.00 as 003-003-02662-0 CSCL 13B

Experimental results of a miniature two-stage Stirling cryocooler are introduced. The influence of filling gas pressure and refrigeration temperature on the refrigerating capacity along with the relationship between parameters was measured. The valley pressure corresponding to the lowest refrigeration temperature and the cooldown time versus operating pressure are discussed. The coefficient of performance and thermodynamic efficiency of the cryocooler are calculated based on experimental data. E.A.K.

N86-11376*# Philips Labs., Briarcliff Manor, New York.
PARAMETRIC TESTING OF A LINEARLY DRIVEN STIRLING CRYOGENIC REFRIGERATOR
F. R. Stolfi and A. Daniels *In* NBS Proc. of the 3rd Cryocooler Conf. May 1985 p 80-98 refs (For primary document see N86-11367 02-31)
(Contract NAS5-25172)
Avail: NTIS MF A01; SOD HC $10.00 as 003-003-02662-0 CSCL 13B

The parametric testing of a novel Stirling cycle cryogenic refrigerator which incorporates electromagnetic bearings, clearance seals and electronically controlled linear motion was studied. The last feature, which involves the use of two linear motors, position transducers and a highly accurate electronic feedback network, produces the system capability which forms the basis for the tests. The test results provide designers with an understanding of the basic operation of the Stirling cycle and give potential users some indication of the capabilities of this refrigerator under off design conditions. E.A.K.

N86-11377*# Philips Labs., Briarcliff Manor, New York.
DESIGN OF A FLIGHT QUALIFIED LONG-LIFE CRYOCOOLER
L. Knox, P. Patt, and R. Maresca *In* NBS Proc. of the 3rd Cryocooler Conf. May 1985 p 99-118 refs (For primary document see N86-11367 02-31)
(Contract NAS5-26688)
Avail: NTIS MF A01; SOD HC $10.00 as 003-003-02662-0 CSCL 13B

A second generation Stirling cycle cryogenic refrigerator with a linear drive, magnetic bearings, and clearance seals; designed to produce 5 watts of cooling at 65 Kelvin and to meet Space Shuttle mission requirements is described. The first generation refrigerator met all performance specifications, and operated with no failure for over 12,030 hours. Meeting launch requirements necessitated improvements in the electromagnetic bearings, the radial position sensors, and in the structural design of the moving elements. Organic contamination was eliminated by the use of all metal and ceramic construction. Reductions in system input power are attained by an integral magnetic spring/motor for the displacer and by more efficient linear motors and drive electronics. E.A.K.

N86-11378*# Technische Hogeschool, Delft (Netherlands). Dept. of Applied Physics.
SIMPLE CONSTRUCTION AND PERFORMANCE OF A CONICAL PLASTIC CRYOCOOLER
N. Lambert *In* NBS Proc. of the 3rd Cryocooler Conf. May 1985 p 119-126 refs (For primary document see N86-11367 02-31)
Avail: NTIS MF A01; SOD HC $10.00 as 003-003-02662-0 CSCL 13B

Low power cryocoolers with conical displacers offer several advantages over stepped displacers. The described fabrication process allows quick and reproducible manufacturing of plastic conical displacer units. This could be of commercial interest, but it also makes systematic optimization feasible by constructing a number of different models. The process allows for a wide range of displacer profiles. Low temperature performance as dominated by regenerator losses, and several effects are discussed. A simple device is described which controls gas flow during expansion. E.A.K.

N86-11379*# Philips Labs., Briarcliff Manor, New York.
EFFECTS OF LEAKAGE THROUGH CLEARANCE SEALS ON THE PERFORMANCE OF A 10 K STIRLING-CYCLE REFRIGERATOR
C. S. Keung and E. Lindale *In* NBS Proc. of the 3rd Cryocooler Conf. May 1985 p 127-134 refs Sponsored in part by Rockwell International Corp. (For primary document see N86-11367 02-31)
Avail: NTIS MF A01; SOD HC $10.00 as 003-003-02662-0 CSCL 13B

The use of clearance seals is essential to achieve long life, wear free operation of Stirling cycle cryogenic refrigerators. The effect of leakage through clearance seals on the performance of such a refrigerator operating at temperatures ranging from 20 K down to 10 K was determined. The ability of a Stirling cycle refrigerator to achieve 10 K with clearance seals was successfully demonstrated. It is indicated that the leakage flow undergoes gap regeneration before reaching the cold expansion volume. A simple model of gap regeneration was used to estimate the regeneration loss due to the leakage flow. This regeneration process minimizes the loss in refrigerator performance caused by the clearance seal leakage. It is found that clearance seals remain effective down to a refrigeration temperature of 10 K. E.A.K.

N86-11380*# Massachusetts Inst. of Tech., Cambridge. Cryogenic Engineering Lab.
AN EXPERIMENTAL RECIPROCATING EXPANDER FOR CRYOCOOLER APPLICATION
Moses Minta and Joseph L. Smith, Jr. *In* NBS Proc. of the 3rd Cryocooler Conf. May 1985 p 135-146 refs (For primary document see N86-11367 02-31)
Avail: NTIS MF A01; SOD HC $10.00 as 003-003-02662-0 CSCL 13B

An experimental reciprocating expander was designed with features appropriate for cryocooler cycles. The expander has a displacer piston, simple valves, and a hydraulic/pneumatic stroking mechanism. The expander has a valve in head configuration with the valves extending out the bottom of the vacuum enclosure while the piston extends out the top. The expander was tested using a CTI 1400 liquefier to supply 13 atm in the temperature range 4.2 to 12 K. Expander efficiency was measured in the range 84 to 93% while operating the apparatus as a supercritical wet expander and in the range 91 to 93% aa a single phase expander. The apparatus can also be modified to operate as a compressor for saturated helium vapor. E.A.K.

N86-11381*# L'Air Liquide, Sassenage (France). Advanced Technology Div.
EXPERIMENTS WITH A FULLY INSTRUMENTED SPLIT STIRLING CRYOCOOLER
Alain Faure, Serge Reale, and Philippe Bernhein *In* NBS Proc. of the 3rd Cryocooler Conf. May 1985 p 147-155 (For primary document see N86-11367 02-31)
Avail: NTIS MF A01; SOD HC $10.00 as 003-003-02662-0 CSCL 13B

A practical model that can be used to accurately size and

optimally split stirling cryocoolers is discussed. A practical model that could be used to extrapolate existing designs to meet different specifications was developed. However, to do this detailed knowledge of the dynamic operating parameters of this type of cryocooler is required. The first stage is to fully instrument a refrigerator so that various dynamic parameters can be measured. The second stage involves the application of these measurements to the design and optimization of a range of coolers. E.A.K.

N86-11382*# Xian Jiaotong Univ. (China). Dept. of Power Machinery Engineering.
LOW FREQUENCY SPLIT CYCLE CRYOCOOLER
S. X. Bian, Y. D. Zhang, W. W. Wan, L. Wang, and Q. C. Hu *In* NBS Proc. of the 3rd Cryocooler Conf. May 1985 p 156-160 refs (For primary document see N86-11367 02-31)
Avail: NTIS MF A01; SOD HC $10.00 as 003-003-02662-0 CSCL 13B

A split cycle Stirling cryocooler with two different drive motors and operating at a low drive frequency can have high thermodynamic efficiency. The temperature of the cold end of the cryocooler varies with drive frequency, voltage of the input electrical power and initial charge pressure values. The cryocooler operating at 8 Hz can provide 7 watts of refrigeration at 77 K for 230 watts of electrical input power. E.A.K.

N86-11383*# Ricor Ltd., En-Harod Ihud (Israel).
PASSIVE MOTION CONTROL OF PNEUMATICALLY DRIVEN DISPLACERS IN CRYOGENIC COOLERS
N. Pundak and S. Shtrikman (Weizmann Inst. of Science) *In* NBS Proc. of the 3rd Cryocooler Conf. May 1985 p 161-167 refs (For primary document see N86-11367 02-31)
Avail: NTIS MF A01; SOD HC $10.00 as 003-003-02662-0 CSCL 13B

The split cryogenic cooler with a remote cold finger offers many advantages for use in cooling of infrared systems. A pneumatic drive for the displacer in such coolers was adopted in many cryocooler designs. This concept can be significantly improved by causing the displacer to move sinusoidally rather than in an essentially square wave, as in most of the present models. The way this motion was achieved passively is described and its advantages outlined. Data of minicoolers using this concept are presented. E.A.K.

N86-11384*# Martini Engineering, Richland, Wash.
A NONPROPRIETARY, NONSECRET PROGRAM FOR CALCULATING STIRLING CRYOCOOLERS
William R. Martini *In* NBS Proc. of the 3rd Cryocooler Conf. May 1985 p 168-176 refs (For primary document see N86-11367 02-31)
Avail: NTIS MF A01; SOD HC $10.00 as 003-003-02662-0 CSCL 13B

A design program for an integrated Stirling cycle cryocooler was written on an IBM-PC computer. The program is easy to use and shows the trends and itemizes the losses. The calculated results were compared with some measured performance values. The program predicts somewhat optimistic performance and needs to be calibrated more with experimental measurements. Adding a multiplier to the friction factor can bring the calculated rsults in line with the limited test results so far available. The program is offered as a good framework on which to build a truly useful design program for all types of cryocoolers. E.A.K.

N86-11385*# National Bureau of Standards, Boulder, Colo. Chemical Engineering Science Div.
A SIMPLE, FIRST STEP TO THE OPTIMIZATION OF REGENERATOR GEOMETRY
Ray Radebaugh and Beverly Louie *In its* Proc. of the 3rd Cryocooler Conf. May 1985 p 177-198 refs Sponsored in part by Naval Ship Research and Development Center and ONR (For primary document see N86-11367 02-31)
Avail: NTIS MF A01; SOD HC $10.00 as 003-003-02662-0 CSCL 13B

This paper presents a simplified set of equations for calculating and optimizing regenerator geometries. A number of competing parameters must be accounted for in the design of a regenerator. To obtain high values of effectiveness, there is need for a large surface area for heat transfer and high heat capacity. The void volume should be small to maintain the pressure ratio in the entire system. Moreover, the pressure drop should be small compared to the absolute pressure. With the assumptions made here, the calculations can be done with a hand calculator. The equations show that the optimum regenerator length, hydraulic radius, and porosity are independent of mass flow rate and the gas cross sectional area is proportional to the mass flow rate. It is shown that using gas gaps between parallel plates produces a significantly better regenerator than is possible with packed spheres or screens, particularly at temperatures below approximately 50%. Author

N86-11386*# National Bureau of Standards, Boulder, Colo. Scientific Computing Div.
A COMPUTATIONAL MODEL FOR A REGENERATOR
John Gary, David E. Daney, and Ray Radebaugh *In its* Proc. of the 3rd Cryocooler Conf. May 1985 p 199-211 refs (For primary document see N86-11367 02-31)
Avail: NTIS MF A01; SOD HC $10.00 as 003-003-02662-0 CSCL 13B

This paper concerns a numerical model of a regenerator running at very low temperatures. The model consists of the usual three equations for a compressible fluid with an additional equation for a matrix temperature. The main difficulty with the model is the very low Mach number (approximately 1.E-3). The divergence of the velocity is not small, the pressure divergence is small, and the pressure fluctuation in time is not small. An asymptotic expansion based on the bounded derivative method of Kreiss is used to give a reduced model which eliminates acoustic waves. The velocity is then determined by a two-point boundary value problem which does not contain a time derivative. The solution obtained from the reduced system is compared with the numerical solution of the original system. Author

N86-11387*# Massachusetts Inst. of Tech., Cambridge. Cryogenic Engineering Lab.
CRITERIA FOR SCALING HEAT EXCHANGERS TO MINIATURE SIZE
Philipp B. RudolfvonRohr and Joseph L. Smith, Jr. *In* NBS Proc. of the 3rd Cryocooler Conf. May 1985 p 212-219 refs (For primary document see N86-11367 02-31)
Avail: NTIS MF A01; SOD HC $10.00 as 003-003-02662-0 CSCL 13B

The purpose of this work is to highlight the particular aspects of miniature heat exchangers performance and to determine an appropriate design approach. A thermodynamic analysis is performed to express the generated entropy as a function of material and geometric characteristics of the heat exchangers. This expression is then used to size miniature heat exchangers. Author

N86-11388*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A CLOSED CYCLE CASCADE JOULE THOMSON REFRIGERATOR FOR COOLING JOSEPHSON JUNCTION MAGNETOMETERS
Emanuel Tward and Raymond Sarwinski (Hansen (R. G.) and Associates, San Diego, Calif.) *In* NBS Proc. of the 3rd Cryocooler Conf. May 1985 p 220-225 refs (For primary document see N86-11367 02-31)
Avail: NTIS MF A01; SOD HC $10.00 as 003-003-02662-0 CSCL 13B

A closed cycle cascade Joule Thomson refrigerator designed to cool Josephson Junction magnetometers to liquid helium temperature is being developed. The refrigerator incorporates 4 stages of cooling using the working fluids CF4 and He. The high pressure gases are provided by a small compressor designed for this purpose. The upper stages have been operated and performance will be described. Author

N86-11389*# Quantum Technology Corp., Surrey (British Columbia).
A SMALL HELIUM LIQUIFIER WHICH PROVIDES CONTINUOUS COOLING BASED ON CYCLED ISENTROPIC EXPANSION
Calvin Winter, Suso Gygax (Simon Fraser Univ.), Ken Myrtle, and Russel Barton *In* NBS Proc. of the 3rd Cryocooler Conf. May 1985 p 226-233 refs Sponsored by Science Council of British Columbia and National Sciences and Engineering Research Council (For primary document see N86-11367 02-31)
Avail: NTIS MF A01; SOD HC $10.00 as 003-003-02662-0 CSCL 13B

This simple cryocooler provides a small reservoir of liquid helium at a stable temperature of 4.2K. It uses a novel adaptation of the Simon expansion cryocooler to provide continuous cooling. Operation is in a four stage cycle: (1) A closed vessel of helium under high pressure is cooled to 12K using a conventional Gifford-McMahon closed-cycle cryocooler. (2) The pressure is released adiabatically providing cooling to 4.2K. (3) Liquid helium is collected in a second, well insulated, vessel. (4) The first vessel is repressurized. The cycle time is 15-30 minutes. In this manner, a pool of liquid helium is continuously maintained in the second vessel, with a temperature stability of 0.03 degrees. The continuous cooling power available is 3mW. This design provides simplicity and reliability through the absence of any orifices or moving parts at cryogenic temperatures except for the conventional Gifford-McMahon cryocooler. Author

N86-11390*# Nihon Univ., Tokyo (Japan). Atomic Energy Research Inst.
VUILLEUMIER CYCLE CRYOCOOLER OPERATING BELOW 8 K
Yoichi Matsubara and Mitsuhiro Kaneko (Suzuki Shokan Co. Ltd.) *In* NBS Proc. of the 3rd Cryocooler Conf. May 1985 p 234-239 refs Sponsored in part by Science and Technology Agency (For primary document see N86-11367 02-31)
Avail: NTIS MF A01; SOD HC $10.00 as 003-003-02662-0 CSCL 13B

This paper describes the design and development of a Vuilleumier cycle cryocooler (VM cooler) operating below 8 K, for the application of small superconducting devices. Liquid nitrogen has been used as a heat sink of the hot displacer. The annular gap between the phenolic displacer and SUS 304 stainless cylinder has been used as a gap regenerator. In order to obtain the cooling temperature below 3 K, we designed a single stage VM cooler which is precooled to 10 K by another two stage VM cooler. The effect of the mean operating pressure, cycle speed and phase difference between the hot and cold displacer of each VM cooler will be also discussed, including the experimental results. Author

N86-11391*# Air Products and Chemicals, Inc., Allentown, Pa.
FOUR K REFRIGERATORS WITH A NEW COMPACT HEAT EXCHANGER
R. C. Longsworth and W. A. Steyert *In* NBS Proc. of the 3rd Cryocooler Conf. May 1985 p 240-249 refs (For primary document see N86-11367 02-31)
Avail: NTIS MF A01; SOD HC $10.00 as 003-003-02662-0 CSCL 13B

Two refrigerators have been developed which have nominal capacities of 0.25M and 0.5W at 4.2K. These use standard two stage Displex sup R expanders and compressors combined with a new compact heat exchanger which is concentric with the expander cylinder. These refrigerators can be used to cool superconducting electronic devices by direct attachment to the 4K heat station, or they can be plugged into the neck of a liquid helium superconducting magnet cryostat where they can cool the radiation shields and reliquefy helium. Author

N86-11392*# Mechanical Technology, Inc., Latham, N. Y.
THE DESIGN OF A SMALL LINEAR-RESONANT, SPLIT STIRLING CRYOGENIC REFRIGERATOR COMPRESSOR
R. A. Ackermann *In* NBS Proc. of the 3rd Cryocooler Conf. May 1985 p 250-256 (For primary document see N86-11367 02-31)
Avail: NTIS MF A01; SOD HC $10.00 as 003-003-02662-0 CSCL 13B

The development of a small linear-resonant compressor for use in a 1/4-watt, 78K, split Stirling cryogenic refrigerator is discussed. The compressor contains the following special features: (1) a permanent-magnet linear motor; (2) resonant dynamics; (3) dynamic balancing; and (4) a close-clearance seal between the compressor piston and cylinder. This paper describes the design of the compressor, and presents component test data and system test data for the compressor driving a 1/4-watt expander. Author

N86-11393*# Ball Aerospace Systems Div., Boulder, Colo. Cryogenics, Space Systems.
JOULE-THOMSON VALVES FOR LONG TERM SERVICE IN SPACE CRYOCOOLERS
James M. Lester and Becky Benedict *In* NBS Proc. of the 3rd Cryocooler Conf. May 1985 p 257-266 ref (For primary document see N86-11367 02-31)
Avail: NTIS MF A01; SOD HC $10.00 as 003-003-02662-0 CSCL 13B

Joule-Thomson valves for small cryocoolers have throttling passages on the order of 0.1 millimeter in diameter. Consequently, they can become plugged easily and stop the operation of the cooler. Plugging can be caused by solid particles, liquids or gases. Plugging is usually caused by the freezing of contaminant gases from the process stream. In small open loop coolers and in closed loop coolers where periodic maintenance is allowed, the problem is overcome by using careful assembly techniques, pure process gases, warm filters and cold adsorbers. A more thorough approach is required for closed loop cryocoolers which must operate unattended for long periods. This paper presents the results of an effort to solve this problem. The causes of plugging are examined, and various ways to eliminate plugging are discussed. Finally, the development of a J-T defroster is explained. It is concluded that a combination of preventive measures and a defroster will reduce the chance of cooler failure by plugging to such a degree that J-T coolers can be used for long term space missions. Author

N86-11394# Joint Publications Research Service, Arlington, Va.
USSR REPORT: MACHINE TOOLS AND METALWORKING EQUIPMENT
4 Sep. 1985 73 p Transl. into ENGLISH from various Russian articles
(JPRS-UMM-85-010) Avail: NTIS HC A04

Research advances in U.S.S.R. machine tools and metal working equipment are reported. Topics covered include automated lines and aggregated machining systems; robotics; and technology planning and management automation. For individual titles, see N86-11395 through N86-11397.

N86-11395# Joint Publications Research Service, Arlington, Va.
LARGE ROBOTIZED TURNING CENTERS DESCRIBED
V. V. Kirsanov and V. I. Tsarenko *In its* USSR Rept.: Machine Tools and Metalworking Equipment (JPRS-UMM-85-010) 4 Sep. 1985 p 43-47 Transl. into ENGLISH from Stroit. i Dorozhnyye Mash. (Moscow), no. 2, Feb. 1985 p 19-20 (For primary document see N86-11394 02-31)
Avail: NTIS HC A04

The introduction of numerical control (NC) machine tools has made it possible to automate machining in series and small series production. The organization of automated production sections merged NC machine tools with automated transport systems. However, both the one and the other require the presence of an operative at the machine for low skilled operations. Industrial robots perform a number of auxiliary operations, such as equipment loading-unloading and control, changing cutting and auxiliary tools, controlling workpieces and parts, and cleaning of location surfaces. When used with a group of equipment they perform transfer operations between the machine tools. Industrial robots eliminate the need for workers to form auxiliary operations. This underscores the importance of developing robotized manufacturing centers

providing for minimal human participation in production and creating conditions for two and three shift operation of equipment. Work carried out at several robotized manufacturing centers for series and small series production is described. B.W.

N86-11396# Joint Publications Research Service, Arlington, Va.
ROBOTIZED PRODUCTION SYSTEMS OBSERVED IN MODERN PLANTS
A. N. Saverina *In its* USSR Rept.: Machine Tools and Metalworking Equipment (JPRS-UMM-85-010) 4 Sep. 1985 p 48-51 Transl. into ENGLISH from Avto. Prom. (Moscow), no. 12, Dec. 1984 p 26-28 (For primary document see N86-11394 02-31)
Avail: NTIS HC A04

Robots, robotized lines and sectors are no longer innovations in shops at automotive plants. The widespread robotization of automobile assembly operations is described in general terms. Robot use for machining operation is also discussed. B.W.

N86-11397# Joint Publications Research Service, Arlington, Va.
ROBOTIZED MACHINING SYSTEMS DEVELOPED AT GOMEL INSTITUTE
N. N. Gulyayev *In its* USSR Rept.: Machine Tools and Metalworking Equipment (JPRS-UMM-85-010) 4 Sep. 1985 p 58-60 Transl. into ENGLISH from Traktory i Selkhozmashiny (Moscow), no. 4, Apr. 1985 p 54 (For primary document see N86-11394 02-31)
Avail: NTIS HC A04

The development of robotized machining systems at Gomel Institute is discussed. Applications, economic benefits, and technological sophistication are discussed in detail. Effects on productivity are also discussed. B.W.

N86-11253*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
RAPID ADHESIVE BONDING AND FIELD REPAIR OF AEROSPACE MATERIALS
Bland A. Stein *In its* Welding, Bonding and Fastening, 1984 Sep. 1985 p 419-438 ref (For primary document see N86-11227 02-23)
Avail: NTIS HC A21/MF A01 CSCL 13H

N86-11403# Hughes Aircraft Co., Canoga Park, Calif. Missile Systems Group.
SHEET METAL WAVEGUIDE FORMING TECHNIQUE
P. K. Park and S. E. Bradshaw *In* RADC Proc. of the 1984 Antenna Appl. Symp. Jan. 1985 p 113-122 refs (For primary document see N86-11398 02-32)
Avail: NTIS HC A13/MF A01 CSCL 13/8

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N86-11398# Rome Air Development Center, Griffiss AFB, N.Y.
PROCEEDINGS OF THE 1984 ANTENNA APPLICATIONS SYMPOSIUM
Jan. 1985 277 p refs Symp. held in Urbana, Ill., 19-21 Sep. 1984; sponsored by RADC and Illinois Univ., Urbana 2 Vol.
(Contract F19628-84-M-0002; AF Proj. 4600)
(AD-A153257; RADC-TR-85-14-Vol-1) Avail: NTIS HC A13/MF A01 CSCL 09/5

Antennas and their applications were discussed. The state of the art as related to: phased array antennas, millimeter wave antennas, microstrip and conformal antennas, reflector antennas, and near field antenna measurement techniques is presented. For individual titles, see N86-11399 through N86-11410.

N86-11399# Massachusetts Univ., Amherst. Dept. of Electrical and Computer Engineering.
CONSIDERATIONS FOR MILLIMETER WAVE, MONOLITHIC PHASED ARRAYS
D. H. Schaubert, D. M. Pozar, K. S. Yngvesson, and R. W. Jackson *In* RADC Proc. of the 1984 Antenna Appl. Symp. Jan. 1985 p 9-36 refs (For primary document see N86-11398 02-32)
(Contract F19628-84-K-0022)
Avail: NTIS HC A13/MF A01 CSCL 09/3

Some candidate elements for millimeter wave, monolithic phased arrays are discussed. Printed antennas on high permittivity substrates are discussed in relation to EHF array performance. Scan impedance and blindness are evaluated by analysis and experiment. Methods for interfacing active devices such as FETs with candidate array elements are discussed. E.A.K.

N86-11400# Harris Government Aerospace Systems Div., Melbourne, Fla.
THE DESIGN OF A THERMALLY EFFICIENT 1:256 KU-BAND FEED NETWORK FOR A MMIC PHASED ARRAY
C. A. Hancik, D. E. Hackaman, and E. J. Bajgrowicz *In* RADC Proc. of the 1984 Antenna Appl. Symp. Jan. 1985 p 37-56 refs (For primary document see N86-11398 02-32)
Avail: NTIS HC A13/MF A01 CSCL 09/3

A thin, thermally transparent, 1:256 corporate feed network for use in a GaAs MMIC Ku-Band phased array antenna was designed. The network will be realized using RF transmission medium, CHANNELINE. The CHANNELINE consists of a core of TFE coated copper wire placed in a channel routed through a heat exchanging metal structure which composes the backside of the array. This unique packaging arrangement conserves both volume and weight while simultaneously allowing the rapid transfer of internally generated heat. This network is expected to realize better than 15 dB of return loss with less than 1.3 dB of return loss with less than 1.3 dB insertion loss over an 8% bandwidth. The current status of array hardware is presented. E.A.K.

N86-11401*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CHARACTERIZATION OF MMIC DEVICES FOR ACTIVE ARRAY ANTENNAS
Jerry Smetana, Everett Farr (Illinois Univ., Urbana), and Raj Mittra (Illinois Univ., Urbana) *In* RADC Proc. of the 1984 Antenna Appl. Symp. Jan. 1985 p 57-82 refs Previously announced as N85-15779 (For primary document see N86-11398 02-32)
Avail: NTIS HC A13/MF A01 CSCL 09C

Certain aspects of monlithic microwave integrated circuit (MMIC) interconnectivity were investigated. Considerations that lead to preserving the inherently reproducible characteristics of the MMIC are proposed. It is shown that at radio frequencies (RF) greater than 20 GHz, the transition from the MMIC device to other transmission media must be an accurate RF match. It is proposed that the RF match is sufficiently critical to include the transition as part of the delivered MMIC package. The model to analyze several transitions is presented. This model consists of a succession of abrupt discontinuities in printed circuit transmission lines. The analysis of these discontinuities is achieved by the Spectral Galerkin technique, to establish the modes and mode that special effects should be coordinated by the active array antenna industry toward standardization of MMIC packaging and characterization. Author

N86-11402# Emerson Electric Co., Calabasas, Calif.
WAVEGUIDE SLOT ARRAY WITH CSC2 THETA (DOT) COS THETA PATTERN
John J. Erlinger and Jeffrey R. Orlow *In* RADC Proc. of the 1984 Antenna Appl. Symp. Jan. 1985 p 83-112 refs (For primary document see N86-11398 02-32)
Avail: NTIS HC A13/MF A01 CSCL 20/14

A planar array of longitudinal shunt slots in rectangular waveguides has been designed to produce a CSC sup 2 theta . COS theta patern in the E-plane and -22-dB sidelobes in the H-plane. The array operates at 15 GHz. The choice of E-plane amplitude and phase distribution, to synthesize the CSC sup 2 theta COS theta pattern shape over the sector 8 deg to 50 deg below broadside, involved a tradeof study. A technique reported

perturbing the roots on a Schelfunoff unit circle to obtain the disired pattern shape was used Twelve roots were perturbed in a systematic way to obtain an optimum amplitude distribution with accompanying phase angles. A method to spread the resultant E-plane distribution and the H-plane Taylor distribution over a circular aperture is described. The mutual coupling between elements is considered for the design. The predicted results show good agreement with measurements. E.A.K.

N86-11403# Hughes Aircraft Co., Canoga Park, Calif. Missile Systems Group.
SHEET METAL WAVEGUIDE FORMING TECHNIQUE c31
P. K. Park and S. E. Bradshaw *In* RADC Proc. of the 1984 Antenna Appl. Symp. Jan. 1985 p 113-122 refs (For primary document see N86-11398 02-32)
Avail: NTIS HC A13/MF A01 CSCL 13/8

A 30 element shunt slot array was designed analytically and fabricated by a sheet metal waveguide forming technique. This technique starts with 10 mil copper sheet which is then photo-etched completely through for slots and half way through for bendlines. The photo etched copper sheet is bent into waveguide with a couple of simple mandrels. Solder paste is applied to the seams and heated. The analytic design process adjusts the slot length and offset of each slot while including the effect of external mutual coupling until the desired aperture distribution and impedance match are achieved. It is shown that the cost effective sheet metal waveguide forming technique is a viable technique. E.A.K.

N86-11404# Raytheon Co., Goleta, Calif.
CONSIDERATIONS FOR EXTENDING THE BANDWIDTH OF ARRAYS BEYOND TWO OCTAVES
George J. Monser *In* RADC Proc. of the 1984 Antenna Appl. Symp. Jan. 1985 p 123-148 (For primary document see N86-11398 02-32)
Avail: NTIS HC A13/MF A01 CSCL 20/14

Array-element characteristics for a wideband, dual-polarized, array where the extension in bandwidth is achieved by extending the lower frequency limit are summarized. Array-element behavior over the lower part of the band is described. A lower frequency limit of operation is advanced based on element mismatch loss and efficiency. It is shown that low active VSWR and good efficiency can be achieved over a two octave band. E.A.K.

N86-11405# Raytheon Co., Bedford, Mass. Missile Systems Div.
MICROSTRIP MONPULSE DIPOLE ARRAY
William Miccioli, John Toth, Norbert Sa, and Michael Lewis *In* RADC Proc. of the 1984 Antenna Appl. Symp. Jan. 1985 p 149-170 refs (For primary document see N86-11398 02-32)
Avail: NTIS HC A13/MF A01 CSCL 09/3

The development of a microstrip radiating aperture utilizing multiple microstrip dipole radiators fed by a resonant feed configuration is described. This array combines an efficient capacitively coupled radiator feeding mechanism with a planar power divider configuration to achieve an extremely thin, lightweight antenna aperture. Linear array dipole matching theory and radiator bandwidth improvement techniques are also described. A quadrant based microstrip monopulse antenna was constructed. Experimental data from this array, its subassemblies and individual components are presented and compared to analytical predictions. E.A.K.

N86-11406# Saint Francis Medical Center, Peoria, Ill. Dept. of Radiology and Medical Imaging.
THEORY AND EXPERIMENT FOR INFINITE MICROSTRIP ARRAYS
Steven M. Wright and Y. T. Lo (Illinois Univ., Urbana) *In* RADC Proc. of the 1984 Antenna Appl. Symp. Jan. 1985 p 171-196 refs (For primary document see N86-11398 02-32)
Avail: NTIS HC A13/MF A01 CSCL 20/14

Microstrip antennas are well suited for use in large scanning arrays. To obtain greater bandwidth, it is useful to use thicker substrates, which can increase the effects of mutual coupling and lead to significant mismatch or blindness for certain scan angles. Using an infinite array formulation, the impedance of a single element in an infinite array environment was solved with the method of moments. Mutual coupling is built into the solution, and the presence of surface waves is accounted for by using the periodic Green's function for the grounded dielectric substrate. Blindness in arrays of microstrip dipoles on various substrates, both with and without radomes is demonstrated. E.A.K.

N86-11407*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CIRCULARLY POLARIZED MICROSTRIP ANTENNAS
Y. T. Lo (Illinois Univ., Urbana), B. Engst (Illinois Univ., Urbana), and R. Q. H. Lee *In* RADC Proc. of the 1984 Antenna Appl. Symp. Jan. 1985 p 197-218 refs (For primary document see N86-11398 02-32)
Avail: NTIS HC A13/MF A01 CSCL 20N

A simple microstrip antenna can be made to radiate EM waves of any polarization, in particular, the circular polarization (CP) without any phasing network and power divider. A simple and accurate theory for this family of antennas was developed. However, the CP bandwidth, (CPBW) the bandwidth in which the axial ratio (AR) is less than a certain specified value, is very small. Most of the experimental designs were made for a feed placed along the diagonal of the patch. It is shown that there are practically infinitely many possible designs with different feed location. The speculation that other designs might give a wider bandwidth is clarified and an effective method for broadening the bandwidth is shown. E.A.K.

N86-11408# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
RADIATION AND SCATTERING PERFORMANCE OF MICROSTRIP ANTENNAS USING EXOTIC SUBSTRATES
J. J. H. Wang *In* RADC Proc. of the 1984 Antenna Appl. Symp. Jan. 1985 p 219-234 refs (For primary document see N86-11398 02-32)
(Contract F19628-84-K-0010)
Avail: NTIS HC A13/MF A01 CSCL 20/14

The scattering and radiation properties are considered in microstrip antenna designs for airborne applications. The use of exotic substrates, instead of simple dielectric substrates, opens up a new dimension, making it much easier to meet both the radiation and scattering requirements. Two types of substrates, the ferromagnetic annd the anisotropic dielectric, are studied for their commercial availability. It was observed that the radiation mode and the scattering mode of the microstrip antenna are often distinctly different. Permittivity and permeability tensor of the substrate are selected to decouple the radiation and scattering modes to achieve simultaneously radiation and scattering performance goals. Analysis techniques used in the design study are discussed. E.A.K.

N86-11409# Rome Air Development Center, Hanscom AFB, Mass. Electromagnetic Sciences Div.
A HIGH-EFFICIENCE, LOW-PHASE ERROR WAVEGUIDE LENS FOR A TRANSFORM FEED ANTENNA
Daniel T. McGrath *In its* Proc. of the 1984 Antenna Appl. Symp. Jan. 1985 p 235-256 refs (For primary document see N86-11398 02-32)
Avail: NTIS HC A13/MF A01 CSCL 09/3

A parallel-plate waveguide microwave lens, constructed as part of the concept development of completely overlapped subarray antennas, was tested. The lens' function is comparable to that of a Rotman lens with 16 inputs and 60 outputs. However, the input face is linear with uniformly spaced monopole elements, and the output face is circular, with monopole elements spaced uniformly in angle. Using a four-way power divider at the center four inputs connected to a line-source array, low sidelobe patterns were measured over a 22% bandwidth. Two major modifications to the antenna were required: (1) it is shown that when placed in an array, the phase center is closer to the monopole, the focal array was moved farther from the circular lens face to give good focusing

at the center frequency; and (2) the mismatch and coupling properties of unequally spaced elements along the circular face varied enough to distort the amplitude taper, causing higher sidelobes, an optimum uniform spacing eliminated the problem, and is shown that it is possible, to find such a spacing that will not degrade the len's performance either as a beamformer or as a transform feed. E.A.K.

N86-11410# Teledyne Micronetics, San Diego, Calif.
COMPUTER-AIDED BIFOCAL DIELECTRIC LENS ANTENNA DESIGN FOR MH WAVE APPLICATION
Sheng Y. Peng *In* RADC Proc. of the 1984 Antenna Appl. Symp. Jan. 1985 p 257-274 refs (For primary document see N86-11398 02-32)
Avail: NTIS HC A13/MF A01 CSCL 09/3

A Bifocal Dielectric Lens Computer Model was developed for the aid in the design analysis and performance evaluation for multiplebeam application. The model calculates and plots lens contour, the aperture distributions, and the corresponding radiation patterns and gain, with the feed located at any point on the focal arc. The ray lattice numerical method proposed by Holt and Mayer is very simple. The two surfaces of lens contour are determined through the ray path length constraints and Snell's refraction law. Design equation and equations for computing the aperture phase distribution at each interbeam location are derived. Sample calculations for lens contour design, aperture phase distributions, and radiation patterns of 8-multiplebeams at 94 GHz are included. E.A.K.

N86-11411# Naval Postgraduate School, Monterey, Calif.
VOICE COMMUNICATIONS OVER PACKET RADIO NETWORKS M.S. Thesis
M. M. Seah Mar. 1985 165 p
(AD-A157478) Avail: NTIS HC A08/MF A01 CSCL 17/2

The use of packet virtual circuit technique for voice communications in military radio networks was investigated. The work was concerned with various aspects of networking which include network modeling, communications techniques, traffic analysis and network control. An attempt has been made to develop a simple yet efficient time slot assignment algorithm . This was analyzed under a variety of slot depths and networks topologies using computer simulation. The Erlang' B results were used to provide more insight into the channel characteristics of the packet radio networks. The capabilities of implementing TDMA/CDMA hybrid schemes in the system were scrutinized. A method to estimate the transmission capacity of the inter-node links was found. We demonstrate its effectiveness in controlling local congestion by computer simulation. Graphical results were presented to highlight the behavior of the proposed packet radio networks. We concluded that an appropriate link weight function would provide efficient and reliable network services. GRA

N86-11412# Mitre Corp., Bedford, Mass.
EVALUATION OF THE DIGITAL ACCESS AND CROSS-CONNECT SYSTEM FOR USE IN THE DEFENSE COMMUNICATIONS SYSTEM Final Report, Oct. 1983 - Sep. 1984
C. A. Danielson and W. J. Uhrich Apr. 1985 121 p
(Contract F19628-84-C-0001)
(AD-A157570; MTR-9238; RADC-TR-85-78) Avail: NTIS HC A06/MF A01 CSCL 17/2

The Digital Access and Cross-Connect System (DACS) is communications equipment which provides electronic patching and test access to individual 64 kb/s channels of T1 digital groups (digroups). Equipment such as the DACS is envisioned for use in the Defense Communications System (DCS) where it would interface with existing digital communications equipment such as those developed in the Digital Radio and Multiplexer Acquisition (DRAMA) program. The testing reported herein addressed issues concerning the interfaces and interoperation of the DACS with the DRAMA equipment. Section 2 describes the DACS and the test installation at Scott AFB. The communications techniques used within the equipment are described and various communications terms are defined. Section 3 goes into the test methodology and relates the test configurations to potential application of the equipment in the DCS. Results of the testing are then presented in the remaining sections. Section 4 addresses various functional characteristics of the equipment. Section 5 presents results of interface testing including a characterization of the DACS and the DRAMA digroup interfaces. Section 6 describes testing related to the important topics of synchronization and timing. In Section 7, the performance parameters monitored by the DACS and the DACS alarms are discussed. Section 8 addresses operator interface characteristics of the equipment. Summary findings and conclusions are contained in Section 9. The appendix describes the test equipment employed during the testing. GRA

N86-11413# California Univ., Livermore. Lawrence Livermore Lab.
UPGRADE OF THE EM TRANSIENT RANGE MONOCONE ANTENNA
R. J. King, K. S. Kunz, H. G. Hudson, R. E. Boberg, S. T. Pennock, and D. K. Gnade May 1985 10 p
(Contract W-7405-eng-48)
(DE85-013181; UCID-20438) Avail: NTIS HC A02/MF A01

Lawrence Livermore National Laboratory has operated an electromagnetic transient range facility (EMTRF) since 1968 using a succession of antennas. This report describes the latest upgrade involving a precision monocone antenna and the use of a shroud of EM absorbing material strategically placed around the antenna to significantly enhance the clear time. This upgrade has resulted in highly repeatable measurements of exterior and interior responses of test objects for frequencies up to approximately 3 GHz for times on the order of hundreds of nanoseconds. Highly resonant interior responses can now be resolved experimentally. The radiated signal is nearly as clean as that from a simple vertical wire radiator and the field intensity is 12 dB larger. The cone is very nearly a true conic with very small azimuthal variations. As expected, the field behaves as 1/r for periods on the order of the time required for the transient pulse to each the cone edge. This perturbation is minimized by the use of strategically placed EM absorber which also serves to increase the clear time by minimizing room reflections. With improve pulsers it may be possible to extend the range of operation of this facility to 10 to 2 GHz. DOE

N86-11414# Los Alamos Scientific Lab., N. Mex.
CALCULATION OF RF FIELDS IN AXISYMMETRIC CAVITIES
Y. Iwashita 1985 5 p Presented at the 5th Conf. on the Computation of Electromagnetic Fields, Fort Collins, Colo., 3 Jun. 1985
(Contract W-7405-eng-36)
(DE85-014135; LA-UR-85-1892; CONF-850641-4) Avail: NTIS HC A02/MF A01

A new code, PISCES, was developed for calculating a complete set of RF electromagnetic modes in an axisymmetric cavity. The finite-element method is used with up to third-order shape functions. Although two components are enough to express these modes, three components are used as unknown variables to take advantage of the symmetry of the element matrix. The unknowns are taken to be either the electric field components or the magnetic field components. The zero-divergence condition will be satisfied by the shape function within each element. DOE

N86-11922# Joint Publications Research Service, Arlington, Va.
ELECTRIC OR MAGNETIC DIPOLE IN STRATIFIED UNIAXIALLY INHOMOGENEOUS ANISOTROPIC MEDIA Abstract Only
Jiasheng Wang *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-014) 2 May 1985 p 74 Transl. into ENGLISH from Yuhang Xuebao (Beijing), no. 1, 31 Jan. 1985 p 24-34 Original language document announced in IAA as A85-42778 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

N86-11923# Joint Publications Research Service, Arlington, Va.
PROPAGATION OF ELECTROMAGNETIC WAVES IN INHOMOGENEOUS AND LOSSY REENTRY PLASMA SHEATH LAYER Abstract Only

Boyi Wang, Yanhou Xu, and Zhenyu Ji *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-014) 2 May 1985 p 75 Transl. into ENGLISH from Yuhang Xuebao (Beijing), no. 1, 31 Jan. 1985 p 35-46 Original language document announced in IAA as A85-42779 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics.*

N86-11415# Air Command and Staff Coll., Maxwell AFB, Ala.
AN INTRODUCTION TO ELECTRICAL BREAKDOWN IN DIELECTRICS
T. L. Skvarenina Apr. 1985 258 p
(AD-A156465; ACSC-85-2470) Avail: NTIS HC A12/MF A01 CSCL 20/3

This report was written to serve as a text for an introductory graduate course in high voltage engineering at the Air Force Institute of Technology. However, anyone with an undergraduate electrical engineering or physics degree should be able to understand it, if they so desire. The material presented falls into three sections. The first part discusses the basics of kinetic theory of gases, atomic structure, ionization, mobility, diffusion, and electron emission. The second portion covers gas breakdown and the characteristics of the glow, corona, and arc discharges. The final portion provides a very brief introduction to the literature.
GRA

N86-11416# Southeastern Center for Electrical Engineering Education, Inc., St. Cloud, Fla.
BASIC EMC TECHNOLOGY ADVANCEMENT FOR C(3) SYSTEMS. VOLUME 3B: COMPUTER SIMULATION OF EMI EFFECTS IN A DIFFERENTIAL LINE RECEIVER Final Technical Report, Sep. 1981 - Dec. 1983
Z. Chair, T. Dave, H. Ouibrahim, and D. Weiner Apr. 1985 68 p
(Contract F30602-81-C-0062)
(AD-A156505; RADC-TR-82-286-Vol-3B) Avail: NTIS HC A04/MF A01 CSCL 17/2

This paper discusses the computer simulation of sinusoidal interference in a National DS 55115 integrated circuit differential line receiver. The receiver is designed to sense differential signals (i.e., differences in the signals at the two terminals of the input port). Typically, the receiver is used in conjunction with the National DS 55114 integrated circuit differential line driver which provides differential output signals with high current capability for driving balanced lines such as twisted pairs. Attention in this effort is focused on the receiver, as opposed to the line driver, because the receiver is significantly more susceptible. Consequently, the susceptibility of the driver-receiver pair is determined by that of the receiver for most interference situations. GRA

N86-11417# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SUBMILLIMETER QUANTUM ELECTRONICS Final Report, 1 Jul. 1982 - 31 Mar. 1985
P. E. Tannenwald 25 Apr. 1985 39 p
(Contracts F19628-80-C-0002; MIPR-ARO-129-85)
(AD-A157432; ARO-19626.9-PH) Avail: NTIS HC A03/MF A01 CSCL 09/3

Tunneling phenomena have been explored in quantum wells consisting of GaAs/GaAlAs (Gallium Arsenide/Aluminum Gallium Arsenide) heterostructure layers that were grown by molecular beam epitaxy. Devices such as detectors and mixers have been fabricated from these quantum wells that showed characteristic tunneling response from DC to 2.5 THz. In addition, the negative differential resistance that was observed was used to demonstrate microwave oscillations up to 20 GHz, both at low temperatures and at room temperature. A variety of other submillimeter experiments are described in the reprints included in the appendices: heterodyning from millimeter wave to optical frequencies using GaAs MESFETs above f sub T, heterodyne radiometry measurements of the 557 GHz water vapor rotational line, development of a submillimeter radiometer using a solid-state local oscillator, and submillimeter astronomical observations carried out at telescope field sites. Also mentioned are persistent photoconductivity observed in quantum wells and a low-IF submillimeter heterodyne receiver to be used in electromagnetic scattering experiments.
Author (GRA)

N86-11418# University Coll., Cork (Ireland). Dept. of Chemistry.
OXIDE CATHODE MECHANISMS: ELECTRONIC AND STRUCTURAL FEATURES OF OXIDE CATHODE SURFACES Final Report, 1 Mar. 1983 - 29 Feb. 1984
J. Cunningham and J. Nunan Jan. 1985 90 p
(Grant AF-AFOSR-0074-83)
(AD-A157666; AFWAL-TR-84-4158) Avail: NTIS HC A05/MF A01 CSCL 09/1

This report describes studies made upon systems selected for their ability to model various important features of oxide cathodes and the mechanisms which enable them to function as efficient thermionic emitters at moderate temperatures. An account is given of experiments which aimed to simulate conditions upon the surfaces of polycrystalline samples of alkaline earth oxides (e.g., SrO and BaO/SrO or MgO and BaO/MgO) at various stages of their preparation in similiar fashion to that used in the thermal activation of oxide cathodes. Accounts are given of experiments which examined the interaction between the gases O2, N2O, H2 or Ch4 and appropriately preactivated surface of pure and mixed alkaline earth oxide samples. Accounts are given of experiments involving the controlled deposition in UHV conditions of zero-valent Ba ad-atoms-in amounts ranging from submonolayer to multilayer coverage - upon layers of SrO or BaO previously prepared in UHV conditions by evaporation of the corresponding metal and its subsequent oxidation. UPS spectra have been undertaken in order to examine surfaces of samples prepared by evaporation of barium metal or strontium metal and to study effects upon the UPS spectra by exposures to the gases N20, O2 and CH4. GRA

N86-11419# Los Alamos National Lab., N. Mex.
MULTI-MEGAMPERE CURRENT INTERRUPTION FROM EXPLOSIVE DEFORMATION OF CONDUCTORS
J. H. Goforth, A. H. Williams, and S. P. Marsh 1985 5 p Presented at the 5th IEEE Pulsed Power Conf., Washington, D.C., 10 Jan. 1985
(Contract W-7405-eng-36)
(DE85-012756; LA-UR-85-1936; CONF-850616-15) Avail: NTIS HC A02/MF A01

Two approaches for using explosives to interrupt current flowing in solid conductors are described. One concept uses explosives to extrude the switch conductor into thin regions that fuse due to current in the switch. A preliminary scaling law is presented. The second approach employs dielectric jets to sever current carrying conductors. A feasibility experiment and an improved design are described. DOE

N86-11420# Los Alamos National Lab., N. Mex.
MULTI-MEGAMPERE OPERATION OF PLASMA COMPRESSION OPENING SWITCHES IN PLANAR GEOMETRY
J. H. Goforth, D. J. Erickson, A. H. Williams, and A. E. Greene 1985 5 p Presented at the 5th IEEE Pulsed Power Conf., Washington, D.C., 10 Jun. 1985
(Contract W-7405-eng-36)
(DE85-012755; LA-UR-85-1939; CONF-850616-14) Avail: NTIS HC A02/MF A01

Experiments are described in which a plasma compression opening switch is used in planar geometry to sharpen the output pulse of an explosive-driven magnetic flux compression generator. The description includes data from tests where peak opening switch currents range from 5.7 to 9.3 MA. The switch is used to transfer

current to a static low-induction load with an efficiency of 50% or better and a risetime as low as 0.45 microns. Results related to current transfer are interpreted within a simple analytical model. DOE

N86-11421# Sandia Labs., Albuquerque, N. Mex.
EXPLOSIVE GENERATORS FOR LOW-COST PULSED POWER
E. Cnare and M. Cowan 1985 22 p Presented at the 5th IEEE Pulsed Power Conf., Washington, D.C., 10 Jun. 1985
(Contract DE-AC04-76DP-00789)
(DE85-013436; SAND-84-2638C; CONF-850616-37) Avail: NTIS HC A02/MF A01

A practical application of explosive generators (MCGs) is to provide relatively low cost pulsed power at very high energy and power to explore high risk technology. A new explosive generator design, which called the Model 632, was designed to bring the cost of prime pulsed power to .001 dollars per joule and 10 to the-7 dollars per watt. The design allows the use of inexpensive liquid explosive and attempts to minimize labor costs in construction of the armature and coil. In its first test, which was carried out with only one half of the designed initial energy, the Model 632 produced 18 MJ at 0.85 TW. The results of the first two tests of the Model 632 explosive generator and a projection of the actual cost of pulse power from this source is discussed. DOE

N86-11422# Sandia Labs., Albuquerque, N. Mex.
AUTOMATED MAGNET TESTING FACILITY
K. T. Lancaster and A. W. Sharpe 1985 11 p Presented at the 5th IEEE Pulsed Power Conf., Washington, D. C., 10 Jun. 1985
(Contract DE-AC04-76DP-00789)
(DE85-012863; SAND-84-2392C; CONF-850616-12) Avail: NTIS HC A02/MF A01

The automated Magnet Testing Facility (MTF) is a computer controlled, 60 kJ, parallel capacitor bank that was constructed to pulse test solenoidal magnets. Coil sets from different vendors are evaluated on two criteria: uniformity of field and coil reliability. The first criterion, uniformity of field, is evaluated by installing a pair of coils into stainless steel housings and pulse mapping the fields at a low energy level. Forty field-strength samples are easily collected with the one button operation of the MTF. Two thousand high field pulse tests, at a 20 kG level, is the second criterion for magnet acceptance. In a manually operated system a single operator can achieve this goal in six months. In a continuous operating mode, MTF can achieve the same goal in 42 days. DOE

N86-11423# Argonne National Lab., Ill.
EFFECTS OF ADDITIVES AND TEMPERATURE ON IRON ELECTRODE BEHAVIOR IN KOH ELECTROLYTES
D. S. Poa, J. F. Miller, and N. P. Yao Apr. 1985 29 p refs
(Contract W-31-109-eng-38)
(DE85-011901; ANL/CEPM-82-2) Avail: NTIS HC A03/MF A01

The effect of temperature, electrolyte additives, and KOH concentration on the electrochemical behavior of iron electrodes in KOH electrolytes was studied by the cyclic voltammetric method. It is indicated that the charging efficiency of the iron electrode will be decreased at lower temperatures. To achieve the same state of charge as that obtained at higher temperatures, a higher charging voltage is required at lower temperatures. The higher charging voltage will increase hydrogen evolution, which will cause the charging efficiency of the iron electrode to decrease. The addition of K2S to the KOH electrolyte can effectively suppress the H2 evolution on the iron electrode during charging. The addition of LiOH to the electrolyte will be beneficial to the stability of the iron electrode, particularly at the transitions from lower to higher oxidation states. The saturation of the KOH electrolyte with FeO causes significant changes in the mechanisms and reaction rates of the electrode reduction-oxidation processes because of the competing reactions of Fe(II) species which become more available at the iron electrode surface. The decrease in reaction rates in more concentrated electrolytes was probably caused by the increased formation of solid film products of higher oxidation states at the electrode surface. DOE

N86-11424# Sandia Labs., Albuquerque, N. Mex.
PARTIAL DISCHARGE FORMATION AND BREAKDOWN IN DEIONIZED WATER UNDER REPETITIVE STRESSING
G. J. Rohwein 1985 26 p Presented at the 5th IEEE Pulsed Power Conf., Washington, D.C., 10 Jun. 1985
(Contract DE-AC04-76DP-00789)
(DE85-013114; SAND-84-2391C; CONF-850616-20) Avail: NTIS HC A03/MF A01

Partial discharges (PD) often precede breakdown in repetitively pulsed megavolt capacitors. This mode of breakdown is believed to result from ionization buildup in the electrode gap from which streamers originate. A series of partial discharge tests using a point plane gap demonstrates that streamers periodically grow out of ionized bushes which tends to support this model. The tests also show water to have well defined corona inception and quench thresholds as well as a low first shot inception level. Data from these tests and related small area breakdown experiments are presented. The random breakdown and recovery characteristics of water are also discussed. DOE

N86-11863# California Univ., Livermore. Lawrence Livermore Lab. Nuclear Energy Systems Div.
NET-2 MODELS OF CAVITIES AND DIODES Abstract Only
George E. Vogtlin *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 11 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

N86-12002# Joint Publications Research Service, Arlington, Va.
A GENERAL PURPOSE CAD PROGRAM FOR MICROWAVE LINEAR CIRCUITS
Yenyang Shih *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-015) 16 May 1985 p 93 refs Transl. into ENGLISH from Tongxin Xuebao (Beijing), no. 2, Apr. 1984 p 60-65 (For primary document see N86-11994 02-70)
Avail: NTIS HC A07/MF A01

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N86-11425*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THEORETICAL AND EXPERIMENTAL COMPARISON OF VAPOR CAVITATION IN DYNAMICALLY LOADED JOURNAL BEARINGS
David E. Brewe, Bernard J. Hamrock (Ohio State Univ., Columbus), and Bo A. Jacobson (Lulea Univ.) 1985 16 p refs Proposed for presentation at the Intern. Symp. on Cavitation, Sendai, Japan, 16-19 Apr. 1986 Prepared in cooperation with Army Aviation Research and Development Command, Cleveland, Ohio
(NASA-TM-87121; E-2729; NAS 1.15:87121;
USAAVSCOM-TR-85-C-19) Avail: NTIS HC A02/MF A01 CSCL 20D

Vapor cavitation for a submerged journal bearing under dynamically loaded conditions was investigated. The observation of vapor cavitation in the laboratory was done by high-speed photography. It was found that vapor cavitation occurs when the tensile stress applied to the oil exceeded the tensile strength of the oil or the binding of the oil to the surface. The theoretical solution to the Reynolds equation is determined numerically using a moving boundary algorithm. This algorithm conserves mass throughout the computational domain including the region of cavitation and its boundaries. An alternating direction implicit (MDI) method is used to effect the time march. A rotor undergoing circular whirl was studied. Predicted cavitation behavior was analyzed by three-dimensional computer graphic movies. The

formation, growth, and collapse of the bubble in response to the dynamic conditions is shown. For the same conditions of dynamic loading, the cavitation bubble was studied in the laboratory using high-speed photography. E.A.K.

N86-11426*# Scientific Concepts, Inc., Potsdam, N.Y.
BRIDGMAN GROWTH OF SEMICONDUCTORS
F. M. Carlson Sep. 1985 34 p refs
(Contract NAS1-16721)
(NASA-CR-177971; NAS 1.26:177971) Avail: NTIS HC A03/MF A01 CSCL 20L

The purpose of this study was to improve the understanding of the transport phenomena which occurs in the directional solidification of alloy semiconductors. In particular, emphasis was placed on the strong role of convection in the melt. Analytical solutions were not deemed possible for such an involved problem. Accordingly, a numerical model of the process was developed which simulated the transport. This translates into solving the partial differential equations of energy, mass, species, and momentum transfer subject to various boundary and initial conditions. A finite element method with simple elements was initially chosen. This simulation tool will enable the crystal grower to systematically identify and modify the important design factors within her control to produce better crystals. Author

N86-11427# Naval Research Lab., Washington, D. C.
ON STRATIFIED VORTEX MOTIONS UNDER GRAVITY Summary Report, 1981 - 1984
Y. T. Fung 20 Jun. 1985 31 p
(RR0-2301)
(AD-A156930; NRL-MR-5564) Avail: NTIS HC A03/MF A01 CSCL 20/4

A general class of stratified vortex flows in investigated in order to understand the vortex patterns developed in stratified late wakes. The flow profiles to be considered vary in both the radial and the axial directions. Three necessary conditions (obtained by the method of generalized progressing wave expansion) and three sufficient conditions (obtained by the integral method of complex conjugation) are discussed for stability of the present flow. As a result, the three necessary and sufficient conditions require that the flow be stable in the centrifugal force field, in the gravitational force field, and in the pressure field that restrains the density variations in the two force fields. A new Brunt-Vaisala frequency and a new Richardson number are proposed as a result of the third stability condition. The newly defined Brunt-Vaisala frequency can be viewed as a measure of the interaction of the density variation in one direction with the force field in the other direction. This Richardson number is a ratio between the interactions of the density variations with the force fields and the interactions of the velocity gradients in two direction. The former interaction is a result of the third stability condition. The latter interaction determines whether the velocity gradients in the second direction strengthens or weakens the resultant shear effect. Because of the generality of the flow profiles being considered, the criteria established in this investigation are valid for a wide range of problems in oceanographic and atmospheric studies. GRA

N86-11428# Scientific Research Associates, Inc., Glastonbury, Conn.
DEVELOPMENT OF A NAVIER-STOKES ANALYSIS FOR THE FLOW IN DISK PUMPS Final Report, Sep. 1984 - Mar. 1985
Y. N. Kim, R. C. Buggeln, and H. McDonald Apr. 1985 45 p
(Contract F33615-84-C-2469)
(AD-A157454; SRA-910008F; AFWAL-TR-85-2039) Avail: NTIS HC A03/MF A01 CSCL 13/7

A technique has been developed to solve the Navier-Stokes equations for the flow in disk pumps. The technique uses a linearized block implicit-alternating direction technique to efficiently solve the unsteady governing equations to a steady state with appropriate boundary conditions and initial conditions. The resulting code was used to calculate the flow in two different geometries under the same flow conditions. Demonstration calculation indicates that the code will be a valuable tool in analytically evaluating the performance of existing and future disk pumps. GRA

N86-11429# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE MEASUREMENTS OF AXISYMMETRIC AIR TURBULENT JET FLOW WITH AN INDIVIDUAL REALIZATION LASER VELOCIMETER SYSTEM
X. Shen, H. Yu, D. Chen, and S. Xie 29 May 1985 23 p Transl. into ENGLISH from Qinghua Daxue Xuebao (China), v. 24, no. 3, 1984 p 26-36
(AD-A157554; FTD-ID(RS)T-0326-85) Avail: NTIS HC A02/MF A01 CSCL 14/2

This paper describes the measurements of axisymmetric air turbulent jet flow with the use of an IRLV system. The distributions of axial mean velocity, turbulent intensity and probability density functions of velocity in the initial region of jet flow were obtained. The data from LV were sampled and processed automatically by a microprocessor. The experiments show that the velocity measurements can be realized even with the air particles in their natural state. The measurements of the mean velocity were also simultaneously made with a hot wire anemometer in order to compare with those made with a LV. Their results were in good coincid ence in the core flow region. The velocity bias was increased with the decrease of data rate and increase of turbulent intensity in the mixing boundary layer. GRA

N86-11430# Naval Ship Research and Development Center, Bethesda, Md.
APPLICATION OF THE VORTEX-LATTICE CONCEPT TO FLOWS WITH SMOOTH-SURFACE SEPARATION Final Report
D. F. Thrasher Jul. 1985 69 p
(AD-A157571; DTNSRDC-85/041) Avail: NTIS HC A04/MF A01 CSCL 20/4

Numerical schemes based on the vortex-lattice concept have had considerable success in treating the fully three-dimensional separated potential flow over low aspect-ratio thin wings at high incidence and the attached potential flow over bodies of more general shape. In principle, the vortex-lattice method is not limited in application as long as convection dominates vorticity diffusion. A non-linear 3-D vortex-lattice method was developed which treats the steady separated flow over prolate bodies with open separation moving through an inviscid incompressible fluid. The strength and position of the body wake were found as part of the solution. Flows with smooth-surface separation were considered as opposed to flows with sharp-edge separation treated with the vortex-lattice concept in the past. Results for flow over an inclined ogive-cylinder demonstrated the technique. For attached flow, comparisons are presented of the results from the vortex-lattice method using optimal and average control point locations with the results of the source-distribution method and with experimental data. The same panel arrangement was used calculating both methods. The results of the present method are somewhat more sensitive to panel arrangement than are those for the source-distribution method. Also, the effect of control point location varies dramatically as the incidence of the body is changed. For separated flow, results of the vortex-lattice method were compared with experimental data and with the results of a typical 2-D analogy. The present method agrees favorably with the experimental data windward of a separation line. GRA

N86-11431# Los Alamos Scientific Lab., N. Mex.
ROTATING FILM RADIATORS FOR SPACE APPLICATIONS
D. R. Koenig 1985 8 p refs Presented at the 20th Intersoc. Energy Conversion Eng. Conf., Miami Beach, Fla., 18 Aug. 1985
(Contract W-7405-eng-36)
(DE85-009633; LA-UR-85-980; CONF-850808-2) Avail: NTIS HC A02/MF A01

A new class of light-weight radiators is described. This radiator consists of a thin rotating envelope that contains the working fluid. The envelope can have many shapes including redundant, foldable configurations. The working fluid, which may be a liquid or a condensable vapor, impinges on the inside surface of the

radiator and is driven as a film to the periphery by centrifugal force. Heat is radiated to space by the outer surface of the envelope. Pumps located on the periphery then return the liquid to the power converter. For a 100-MW radiator operating at 800 K, specific mass approx. 0.1 kg/kW and mass density approx. 2 kg/m(2) may be achievable. DOE

N86-11432# Argonne National Lab., Ill.
BLOCK-IMPLICIT COUPLED CALCULATION OF FLUID FLOWS
S. P. Vanka 1985 7 p Presented at the 5th Symp. on Turbulent Shear Flows, Ithaca, N.Y., 7 Aug. 1985
(Contract W-31-109-eng-38)
(DE85-004038; CONF-850820-1) Avail: NTIS HC A02/MF A01

The development of turbulence models for multidimensional flows heavily relies on the availability of accurate and efficient numerical solution algorithms for the governing partial differential equations. Several techniques have been developed in the past based on finite difference and finite element methods and have employed a variety of implicitness in the differencing and solution of the equations. A popular approach in solving the equations, at least of the finite difference variety, is a decoupled sequential solution of the individual equations. Such methods are employed by the Los Alamos group and by the Imperial College group. The decoupled methods typically solve a pressure or pressure correction equation in lieu of the continuity equation and employ a guess and correct procedure for determining the pressure field. The performance of the coupled block implicit solution technique is presented in various steady flow situations. Techniques for maintaining the requirements of computer storage small and improving the computing speed through preordering and domain splitting techniques are discussed. Attempts to extend the method to three dimensions are also discussed. DOE

N86-11433# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
HIGH TEMPERATURE MOLTEN SALT CONTAINMENT
K. Y. Wang, R. E. West, F. Kreith, and P. P. Lynn May 1985 64 p
(Contract DE-AC02-83CH-10093)
(DE85-012152; SERI/TR-252-2490) Avail: NTIS HC A04/MF A01

The feasibility of several design options for high-temperature, sensible heat storage containment is examined. The major concerns for a successful containment design include heat loss, corrosive tolerance, structural integrity, and cost. This study is aimed at identifying the most promising high-temperature storage tank among eight designs initially proposed. The study is based on the heat transfer calculations and the structure study of the tank wall and the tank foundation and the overall cost analyses. The results indicate that the single-tank, two-media sloped wall tank has the potential of being lowest in cost. Several relevant technical uncertainties that warrant further research efforts are also identified. DOE

N86-11434# Argonne National Lab., Ill.
BLOCK-IMPLICIT MULTIGRID CALCULATION OF THREE-DIMENSIONAL RECIRCULATING FLOWS
S. P. Vanka 1985 13 p Presented at the 4th Intern. Conf. on Numer. Methods in Laminar and Turbulent Flow, Swansea, England, 8 Jul. 1985
(Contract W-31-109-eng-38)
(DE85-010250; CONF-850745-3) Avail: NTIS HC A02/MF A01

An efficient finite difference calculation procedure for three-dimensional recirculating flows is presented. The algorithm is based on a coupled solution of the three-dimensional momentum and continuity equations in primitive variables by the multigrid technique. A symmetrical coupled Gauss-Siedel technique is used for iterations and is observed to provide good rates of smoothing. Calculations were made of the fluid motion in a three-dimensional cubic cavity with a moving top wall. The efficiency of the method is demonstrated by performing calculations at different Reynolds numbers with finite difference grids as large as 66 x 66 x 66 nodes. The CPU times and storage requirements for these calculations are observed to be very modest. The algorithm has the potential to be the basis for an efficient general purpose calculation procedure for practical fluid flows. DOE

N86-11435# Los Alamos Scientific Lab., N. Mex.
INTRODUCTION TO THE SESSION ON: NUMERICAL METHODS FOR TWO-PHASE FLOW
B. Wendroff 1985 7 p Presented at the 11th Intern. Assoc. of Math. and Computers Simulation World Congr., Oslo, 5 Aug. 1985
(Contract W-7405-eng-36)
(DE85-012651; LA-UR-85-1629; CONF-850861-2) Avail: NTIS HC A02/MF A01

The six equation model without artificial correction terms is the simplest one which models the physics as correctly as we can, given that the averaging process is imprecise. Once that idea is accepted the next step is to try to evaluate the limitations of standard difference schemes applied to an ill-posed problem of this type. Analysis of simple cases shows that there are schemes which are quasi-stable (q-stable), by which I mean that errors are not amplified if the mesh size is not too small. Of course, even well-posed problems have limits on mesh size; too fine a mesh will take too much computer time or have unacceptable growth of round-off error. Here we have an additional mesh constraint, but whether or not it is more restrictive than the others is a function of the particular situation being modeled. For example, if the lowest order effects such as phase changes and friction are dominant then the q-stability condition on the mesh will still allow a mesh small enough to obtain accuracy consistent with the accuracy of the data. DOE

N86-11505*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TURBINE HEAT TRANSFER
John E. Rohde *In its* Turbine Eng. Hot Sect. Technol. (HOST) Oct. 1983 p 73-77 (For primary document see N86-11495 02-39)
Avail: NTIS HC A11/MF A01 CSCL 20D

N86-11506*# Tennessee Univ. Space Inst., Tullahoma.
GAS FLOW ENVIRONMENTAL AND HEAT TRANSFER NON-ROTATING 3D PROGRAM
T. Geil and J. Steinhoff *In* NASA. Lewis Research Center Turbine Eng. Hot Sect. Technol. (HOST) Oct. 1983 p 79-86 (For primary document see N86-11495 02-39)
(Contract NAS3-23278)
Avail: NTIS HC A11/MF A01 CSCL 20D

N86-11507*# Detroit Diesel Allison, Mich.
GAS SIDE HEAT TRANSFER
Larry D. Hylton *In* NASA. Lewis Research Center Turbine Eng. Hot Sect. Technol. (HOST) Oct. 1983 p 87-99 refs (For primary document see N86-11495 02-39)
(Contracts NAS3-22761; NAS3-23695)
Avail: NTIS HC A11/MF A01 CSCL 20D

N86-11508*# United Technologies Research Center, East Hartford, Conn.
ASSESSMENT OF A 3-D BOUNDARY LAYER CODE TO PREDICT HEAT TRANSFER AND FLOW LOSSES IN A TURBINE
Veer N. Vatsa *In* NASA. Lewis Research Center Turbine Eng. Hot Sect. Technol. (HOST) Oct. 1983 p 101-106 refs (For primary document see N86-11495 02-39)
(Contract NAS3-23716)
Avail: NTIS HC A11/MF A01 CSCL 20D

N86-11509*# United Technologies Research Center, East Hartford, Conn.
GAS-SIDE HEAT TRANSFER WITH ROTATION
Robert P. Dring *In* NASA. Lewis Research Center Turbine Eng. Hot Sect. Technol. (HOST) Oct. 1983 p 107-109 refs (For primary document see N86-11495 02-39)
Avail: NTIS HC A11/MF A01 CSCL 20D

N86-11510*# Pratt and Whitney Aircraft Group, East Hartford, Conn.

COOLANT PASSAGE HEAT TRANSFER WITH ROTATION. A PROGRESS REPORT ON THE COMPUTATIONAL ASPECTS
L. D. Aceto and G. J. Sturgess *In* NASA. Lewis Research Center Turbine Eng. Hot Sect. Technol. (HOST) Oct. 1983 p 111-116 refs (For primary document see N86-11495 02-39)
Avail: NTIS HC A11/MF A01 CSCL 20D

N86-11511*# Arizona State Univ., Tempe. Dept. of Mechanical and Aerospace Engineering.
JET ARRAY IMPINGEMENT HEAT TRANSFER CHARACTERISTICS
L. W. Florschuetz and D. E. Metzger *In* NASA. Lewis Research Center Turbine Eng. Hot Sect. Technol. (HOST) Oct. 1983 p 117-128 refs (For primary document see N86-11495 02-39)
Avail: NTIS HC A11/MF A01 CSCL 20D

N86-11866# California Univ., Livermore. Lawrence Livermore Lab. Nuclear Test Engineering Div.
ICARUS: A COMPUTER CODE FOR MODELING COMPLEX ONE-DIMENSIONAL HEAT CONDUCTION ON MAINFRAMES AND MICROS Abstract Only
Steven B. Sutton *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 16 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

N86-11867# Sandia Labs., Albuquerque, N. Mex.
THREE-DIMENSIONAL HEAT TRANSFER ANALYSIS USING THE PATRAN-G SOLIDS MODELING AND Q-TRAN THERMAL ANALYSIS COMPUTER CODES Abstract Only
James M. Nelsen, Jaime L. Moya, and H. Richard Yoshimura *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 17 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

N86-11868# Sandia Labs., Albuquerque, N. Mex. Structural Mechanics Div.
INTERFACE ELEMENTS FOR HEAT TRANSFER ANALYSIS Abstract Only
William E. Mason *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 17 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

N86-11879# Sandia Labs., Albuquerque, N. Mex.
A TIME-SPLITTING NUMERICAL TECHNIQUE FOR SOLVING HIGHLY COUPLED TWO-PHASE FLOW CONSERVATION EQUATION Abstract Only
R. J. Gross and M. R. Baer *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 48-49 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

N86-11882# Sandia Labs., Albuquerque, N. Mex. Thermofluids Div.
SIMULATION OF FLAME PROPAGATION THROUGH VORTICITY REGIONS USING THE DISCRETE VORTEX METHOD Abstract Only
Pamela K. Barr *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 59 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

N86-11883# Sandia Labs., Albuquerque, N. Mex.
APPLICATION OF FLUX-CORRECTED TRANSPORT (FCT) TO HEAT TRANSFER/FLUID MECHANICS PROBLEMS Abstract Only
R. J. Gross, M. R. Baer, and C. E. Hickox *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 60 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

N86-11884# Sandia Labs., Albuquerque, N. Mex. Analytical Thermal/Fluid Mechanics Div.
HEAT TRANSFER AND PRESSURE CHANGES DUE TO A LARGE TEMPERATURE DIFFERENCE ACROSS AN ENCLOSED VERTICAL AIR LAYER Abstract Only
D. R. Chenoweth and S. Paolucci *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 61-62 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

N86-11886# Sandia Labs., Albuquerque, N. Mex. Thermofluids Div.
A HYBRID VORTEX-IN-CELL FINITE-DIFFERENCE NUMERICAL METHOD FOR TURBULENT SHEAR LAYER COMPUTATION Abstract Only
Nagi N. Mansour *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 95-96 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

N86-11887# California Univ., Livermore. Lawrence Livermore Lab. Nuclear Explosives Engineering Div.
COMPUTER CODES FOR FLUID-STRUCTURE INTERACTIONS Abstract Only
W. H. McMaster *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 96 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

N86-11954# Joint Publications Research Service, Arlington, Va.
HYDRODYNAMICS OF LIQUID-VAPOR DISPERSE ANNULAR FLOWS IN CHANNELS CONTAINIG BUNDLES OF HEATED RODS UNDER NONSTEADY-STATE CONDITIONS Abstract Only
A. Ye. Kroshilin, V. Ye. Kroshilin, and B. I. Nigmatulin *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 10 refs Transl. into ENGLISH from Teplofiz. Vys. Temp. (Moscow), v. 22, no. 5, Sep. - Oct. 1984 p 933-940 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

N86-11962# Joint Publications Research Service, Arlington, Va.
INFLUENCE OF PHYSICAL-CHEMICAL PROPERTIES OF GASES ON INTERACTION BETWEEN SHOCKWAVES AND CONVEX CYLINDRICAL SURFACES Abstract Only.
L. G. Gvozdeva, Yu. P. Lagutov, and V. P. Fokeyev *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 31 refs Transl. into ENGLISH from Inzhenerno-Fiz. Zh. (Minsk), v. 48, no 2, Feb. 1985 p 239-244 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources.* For related information see also *06 Aircraft Instrumentation,* and *19 Spacecraft Instrumentation.*

N86-11436*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Chemistry.
DIRECT COUPLING OF MICROBORE HPLC COLUMNS TO MS SYSTEMS Final Report, 1 Mar. 1984 - 31 Mar. 1985
Harold M. McNair 31 Mar. 1985 16 p refs
(Grant NAG1-343)
(NASA-CR-176292; NAS 1.26:176292) Avail: NTIS HC A02/MF A01 CSCL 14B

A detailed investigation using electron microscopy was conducted which examined the conditions of materials used in the construction of stable, high performance microbore liquid chromato-

graphy (LC) columns. Small details proved to be important. The effects of temperature on the elution of several homologous series used as probe compounds was examined in reverse phase systems. They showed that accessible temperature changes provide roughly half the increase in solvent strength that would be obtained going from a 100% aqueous to a 100% organic mobile phase, which is sufficient to warrant their use in many analyses requiring the use of gradients. Air circulation temperature control systems provide the easiest means of obtaining rapid, wide range changes in column temperature. However, slow heat transfer from the gas leads to thermal nonuniformity in the column and a decrease in resolution as the temperature program progresses. B.W.

N86-11437*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
WIND TUNNEL SEEDING SYSTEMS FOR LASER VELOCIMETERS
William W. Hunter, Jr., comp. and Cecil E. Nichols, Jr., comp. Washington Oct. 1985 264 p refs Workshop held in Hampton, Va., 19-20 Mar. 1985
(NASA-CP-2393; L-16013; NAS 1.55:2393) Avail: NTIS HC A12/MF A01 CSCL 14B

The principal motivating factor for convening the Workshop on the Development and Application of Wind Tunnel Seeding Systems for Laser Velocimeters is the necessity to achieve efficient operation and, most importantly, to insure accurate measurements with velocimeter techniques. The ultimate accuracy of particle scattering based laser velocimeter measurements of wind tunnel flow fields depends on the ability of the scattering particle to faithfully track the local flow field in which it is embedded. A complex relationship exists between the particle motion and the local flow field. This relationship is dependent on particle size, size distribution, shape, and density. To quantify the accuracy of the velocimeter measurements of the flow field, the researcher has to know the scattering particle characteristics. In order to obtain optimum velocimeter measurements, the researcher is striving to achieve control of the particle characteristics and to verify those characteristics at the measurement point. Additionally, the researcher is attempting to achieve maximum measurement efficiency through control of particle concentration and location in the flow field. For individual titles, see N86-11438 through N86-11457.

N86-11438*# Arnold Engineering Development Center, Arnold Air Force Station, Tenn.
CALCULATION OF PARTICLE DYNAMICS EFFECTS ON LASER VELOCIMETER DATA
Robert H. Nichols *In* NASA. Langley Research Center Wind Tunnel Seeding Systems for Laser Velocimeters Oct. 1985 p 1-11 refs (For primary document see N86-11437 02-35)
Avail: NTIS HC A12/MF A01 CSCL 14B

In order to analytically assess the effects of particle dynamics on laser velocimeter measurements, the particle response to the fluid in which it is entrained must be modeled. The equation of particle motion derived at Arnold Engineering and Development Center (AEDC), is used to model the motion of the particle. The equation is derived from the Navier-Stokes equation under the assumption of unsteady Stokes flow. It should be noted that the Stokes flow eliminates the need for a far field boundary condition, and hence eliminates any normal (lift) forces. To extend the equation to higher particle slip velocities, the Stokes drag is replaced with the particle drag law, modified to include heat transfer effects. The drag coefficient accounts for inertial, rarefaction, compressibility, shape, and heat transfer effects. Author

N86-11439*# Case Western Reserve Univ., Cleveland, Ohio. Center for Complex Flow Measurements.
CORRECTING FOR PARTICLE COUNTING BIAS ERROR IN TURBULENT FLOW
Robert V. Edwards and William Baratuci *In* NASA. Langley Research Center Wind Tunnel Seeding Systems for Laser Velocimeters Oct. 1985 p 13-28 refs (For primary document see N86-11437 02-35)
Avail: NTIS HC A12/MF A01 CSCL 14B

An ideal seeding device is proposed generating particles that exactly follow the flow out are still a major source of error, i.e., with a particle counting bias wherein the probability of measuring velocity is a function of velocity. The error in the measured mean can be as much as 25%. Many schemes have been put forward to correct for this error, but there is not universal agreement as to the acceptability of any one method. In particular it is sometimes difficult to know if the assumptions required in the analysis are fulfilled by any particular flow measurement system. To check various correction mechanisms in an ideal way and to gain some insight into how to correct with the fewest initial assumptions, a computer simulation is constructed to simulate laser anemometer measurements in a turbulent flow. That simulator and the results of its use are discussed. Author

N86-11440*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ESTIMATION OF PARTICLE SIZE BASED ON LDV MEASUREMENTS IN A DE-ACCELERATING FLOW FIELD
James F. Meyers *In its* Wind Tunnel Seeding Systems for Laser Velocimeters Oct. 1985 p 29-51 refs (For primary document see N86-11437 02-35)
Avail: NTIS HC A12/MF A01 CSCL 14B

The accuracy of velocity measurements made with a laser velocimeter is strongly dependent upon the response of the seeding particles to the dynamics of the flow field. The smaller the particle the better the response to flow fluctuations and gradients and therefore the more accurate velocity measurement. In direct conflict is the requirement of light scattering efficiency to obtain signals with the laser velocimeter which, in general, is better as the particle size is increased. In low speed flow fields these two requirements on particle size overlap and accurate measurements may be obtained. However in high speed flows, where the velocity gradients may be severe, very small particles are required to maintain sufficient dynamic response characteristics to follow the flow. Therefore if velocity measurements are to be made in these flows, the laser velocimeter must be designed with sufficient sensitivity to obtain signals from these small particles. An insitu determination of the size distribution of kaolin particles (Al2O3, .2 + or - SiO2 . 2H2O) in the 16-foot Transonic Tunnel and the sensitivity characteristics of the laser velocimeter system is described. Author

N86-11441*# Calspan Field Services, Inc., Arnold AFS, Tenn.
PARTICLE SIZE DISTRIBUTIONS OF SEVERAL COMMONLY USED SEEDING AEROSOLS
F. L. Crosswy *In* NASA. Langley Research Center Wind Tunnel Seeding Systems for Laser Velocimeters Oct. 1985 p 53-75 refs (For primary document see N86-11437 02-35)
Avail: NTIS HC A12/MF A01 CSCL 14B

During the course of experimentation, no solid particle powder could be found which produced an aerosol with a narrow particle size distribution when fluidization was the only flow process used in producing the aerosol. The complication of adding particle size fractionation processes to the aerosol generation effort appears to be avoidable. In this regard, a simple sonic orifice is found to be effective in reducing the percentage of agglomerates in the several metal oxide powders tested. Marginally beneficial results are obtained for a 0.5/99.5 percent by weight mixture of the flow agent and metal oxide powder. However, agglomeration is observed to be enhanced when the flow agent percentage is increased to 5 percent. Liquid atomization using the Collison nebulizer as well as a version of the Laskin nozzle resulted in polydispersed aerosols with particle size distributions heavily weighted by the small particle end of the size spectrum. The aerosol particle size distributions produced by the vaporization/condensation seeder are closer to the ideal monodispersed aerosol than any of the other aerosols tested. In addition, this seeding approach affords a measure of control over particle size and particle production rate. Author

N86-11442*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EXPERIMENTS WITH SOLID PARTICLE SEEDING

Cecil E. Nichols, Jr. *In its* Wind Tunnel Seeding Systems for Laser Velocimeters Oct. 1985 p 77-84 (For primary document see N86-11437 02-35)
Avail: NTIS HC A12/MF A01 CSCL 14B

Kaoline, a hydrated aluminum silicate clay, is investigated as a seeding material for laser velocimetry. It is inexpensive but is polydispersed with some of the fineparticles being too large to follow wind tunnel flow and is in the form of nonspherical platelets having an aspect ratio of approximately 4/1. Gravity sedimentation experiments as a means of narrowing the fineparticle sizes distribution are being conducted. The fineparticle size distribution of Engelhard ASP 200 kaolin suspended in ethanol (0.00792 grams kaolin/ml ethanol) as received, after 24 hours gravity sedimentation and after 48 hours sedimentation, respectively is shown. A shearing atomizer is used to inject the fineparticles. Gravity sedimentation is carried out in an 800 ml pyrex beaker. Following gravity sedimentation, the top 3.5 inches are siphoned from the liquid, which has a column height of 4.5 inches. In a like manner, longer settling times will serve to further narrow the fineparticle distribution range. As successive sedimentations are effected, the number of fineparticles per unit volume of ethanol decreased markedly.
Author

N86-11443*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SEEDING TECHNIQUES USED IN THE VORTEX RESEARCH FACILITY
Dale R. Satran *In its* Wind Tunnel Seeding Systems for Laser Velocimeters Oct. 1985 p 85-92 refs (For primary document see N86-11437 02-35)
Avail: NTIS HC A12/MF A01 CSCL 14B

For many years, the Vortex Research Facility used kerosene vapor as seeding particles. The kerosene vapor formed (approx. 1 micron) particles initially. After injection into the test section, the vapor would begin to condense and form larger particles. By switching to solid particles, this has been eliminated. The uniform-sized (approx. 1 micron) solid particle seeding is used both to seed the Laser Velocimeter system and for flow visualization. After injection, the solid particles reach a uniform suspension before the vehicle is launched. It is found that the kerosene vapor poses a problem because it is a heated gas which modified the test section temperature distribution. It also produces high turbulence and secondary air currents because it was continually injected from the time of vehicle launch until model passage. In cases where the effects of either turbulence or the vertical temperature distribution are of interest, this hot gas injection method is unsuitable. Both types of seeding particles provide adequate flow visualization but are sensitive to vertical temperature distributions.
Author

N86-11444*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SEEDING SYSTEMS FOR USE WITH A LASER VELOCIMETER IN LARGE SCALE WIND TUNNELS
Joe W. Elliott (Army Structures Lab.) and Cecil E. Nichols, Jr. *In its* Wind Tunnel Seeding Systems for Laser Velocimeters Oct. 1985 p 93-103 refs (For primary document see N86-11437 02-35)
Avail: NTIS HC A12/MF A01 CSCL 14B

Three seeding systems have been used in the 4- by 7- Meter Tunnel at NASA Langley Research Center: Kerosene smoke, solid particle dry dispersing, and solid particle liquid dispersing. It is anticipated that the liquid dispersing system will be used in all future applications at this facility because: (1) it has a steady output; (2) it is easy to operate and reconfigure; and, (3) it delivers particles of near uniform size.
Author

N86-11445*# United Technologies Research Center, East Hartford, Conn.
OVERVIEW OF SOLID PARTICLE LV SEEDING TECHNIQUES USED AT UTRC
William P. Patrick *In* NASA. Langley Research Center Wind Tunnel Seeding Systems for Laser Velocimeters Oct. 1985 p 105-113 refs (For primary document see N86-11437 02-35)
Avail: NTIS HC A12/MF A01 CSCL 14B

Due to the failure of existing seeders to meet the stringent specifications required for benchmark experiments in high pressure, high temperature, rapidly accelerating flowfields, an effort is made to improve an existing solid particle seeder. The goal is to produce a more monodisperse seed from the 0.3 micro alumina powder with more than 99 percent of the particles in the submicron range while maintaining a high seeding rate. Coiled-wire inserts are installed within the ends of the nitrogen injection lines in the primary seeder to produce swirling conical jets to vigorously agitate the seed bed. A secondary swirler, constructed from a 25 cm length of 3.8 cm ID steel pipe having threaded end caps, is connected to the output line of the primary seeder. The seeded nitrogen from the primary seeder is injected tangentially at near sonic velocity into the secondary swirler 9.4 cm above its base. Independently controlled auxiliary nitrogen used to increase the swirl in the secondary chamber is also injected tangentially 2.5 cm below the seeded nitrogen lines. Large seed particles are collected by bleeds in the swirler cap and directed overboard. The remaining seeded nitrogen is collected on the center line of the secondary swirler and ducted to the rig.
Author

N86-11446*# Sandia Labs., Livermore, Calif.
SEEDING REQUIREMENTS FOR SCANNING LASER VELOCIMETRY
Colin E. Hackett *In* NASA. Langley Research Center Wind Tunnel Seeding Systems for Laser Velocimeters Oct. 1985 p 115-120 (For primary document see N86-11437 02-35)
(Contract DE-AC04-76DP-00789)
Avail: NTIS HC A12/MF A01 CSCL 14B

To measure the velocity distributions within time dependent turbulent flow fields, a continuously scanning laser velocimeter system is being developed at Sandia National Laboratories Livermore (SNLL). A prototype of this system has produced results which show that spatial and temporal variations in particle seed distribution seriously compromise the overall performance and operation of this device. To alleviate some of these problems, alternate flow seeding concepts are explored. The most promising appear to be those that actively induce laser sparks within the gas flow, the velocity of which may be measured by a Fourier transformed velocimetry system.
Author

N86-11447*# Calspan Field Services. Inc., Arnold AFS, Tenn.
RECENT EXPERIENCE IN SEEDING TRANSONIC/SUPERSONIC FLOWS AT AEDC
Fred L. Heltsley *In* NASA. Langley Research Center Wind Tunnel Seeding Systems for Laser Velocimeters Oct. 1985 p 121-140 refs (For primary document see N86-11437 02-35)
Avail: NTIS HC A12/MF A01 CSCL 14B

The laser velocimeter has been utilized for several years at the Arnold Engineering and Development Center (AEDC) as a flow diagnostics tool. Most applications, following the initial proof-of-concept experiments, have involved relatively complex unknown flow fields in which the more conventional, intrusive techniques had either not been attempted or had yielded unsatisfactory results. A blunt-base nozzle-afterbody base flow study is discussed as a respresentative example of such applications. A wide variety of problems have been encountered during these tests, many of which have proven to be closely related to the size and/or size distribution of the seeding material within the fluid. Resulting measurement uncertainties could often not be conclusively resolved because of the unknown nature of the flow field. The other experiments listed were conducted to provide known aerodynamic conditions for comparison with the velocimeter results.
Author

N86-11448*# Notre Dame Univ., Ind. Dept. of Aerospace and Mechanical Engineering.
LASER VELOCIMETRY MEASUREMENT IN A TRANSONIC TUNNEL
T. Terry Ng and Thomas J. Mueller *In* NASA. Langley Research Center Wind Tunnel Seeding Systems for Laser Velocimeters Oct. 1985 p 141-148 ref (For primary document see N86-11437

02-35)
Avail: NTIS HC A12/MF A01 CSCL 14B

Some preliminary velocity measurements were carried out inside the transonic tunnel using the laser velocimeter (LV) system in association with the smoke generator. Pressure measurements were also performed using a pressure tap located on the side wall of the test section slightly upstream of the windows. Though the pressure measurements and the LV measurements were not taken at exactly the same location, extrapolation of the pressure data into the location of the LV measurements indicated a very close agreement between the velocity values obtained using the two different methods. Thus it is believed that the smoke particle is following the air flow with little or no velocity slip. Velocity measurements with airfoil at various angles of attack are now being carried out in conjuction with schlieren flow visualization. In the near future pressure distribution around and on the airfoil will be obtained by putting pressure taps on the side windows and using a pressure tap model (currently under construction) of the airfoil. Author

N86-11449*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PARTICLE GENERATION EXPERIENCE IN LANGLEY'S 16-FOOT TRANSONIC TUNNEL
David E. Reubush *In its* Wind Tunnel Seeding Systems for Laser Velocimeters Oct. 1985 p 149-167 refs (For primary document see N86-11437 02-35)
Avail: NTIS HC A12/MF A01 CSCL 14B

The Langley 16-Foot Transonic Tunnel is a single-return, continuous-flow, atmospheric tunnel which uses air exchange for cooling. The tunnel speed is continuously variable from Mach 0 to 1.30. The test section is a regular octagon in cross-section with slots at the corners of the octagon. The laser velocimeter optics, laser, photomultipliers, etc. are mounted in the test section plenum chamber which surrounds the test section. The test volume is approximately a 1-meter cube about the tunnel center line centered on tunnel station 40.84 meters. The seeding system particle generators are mounted on the upstream side of the fourth set of turning vanes approximately 49 meters upstream of the test volume. At this point the tunnel has a diameter of 17.68 meters which meant that installation of the generators was a difficult procedure. It might be noted that particle generation had to be continuous as when the generators were turned off the data rate rapidly deteriorated to zero. Author

N86-11450*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
LDA SEEDING SYSTEM FOR THE LANGLEY LOW TURBULENCE PRESSURE TUNNEL
J. Scheiman and Laguduva R. Kubendran *In its* Wind Tunnel Seeding Systems for Laser Velocimeters Oct. 1985 p 169-178 refs (For primary document see N86-11437 02-35)
Avail: NTIS HC A12/MF A01 CSCL 14B

A Laser Velocimetry (LV) seeding system was specifically developed for the Langley Low Turbulence Wind Tunnel (LTPT), and it has been successfully used for LV measurements in two major tests (Juncture Flow Experiment and Gortler Experiment). The LTPT is capable of operating at Mach numbers from 0.05 to 0.50 and unit Reynolds numbers from 100,000 to 15,000,000 per foot. The test section is 3 feet wide and 7.5 feet high. The turbulence level in the test section is relatively low because of the high contraction ratio and because of the nine turbulence reduction screens in the settling chamber. A primary requirement of the seeding system was that the seeding material not contaminate or damage in any way these screens. Both solid and liquid seeding systems were evaluated, and the results are presented. They can provide some guidelines for setting up seeding systems in other similar tunnels. Author

N86-11451*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SEEDING SUBSONIC, TRANSONIC AND SUPERSONIC FLOWS WITH 0.5 MICRON POLYSTYRENE SPHERES
H. Lee Seegmiller *In* NASA. Langley Research Center Wind Tunnel Seeding Systems for Laser Velocimeters Oct. 1985 p 179-187 refs (For primary document see N86-11437 02-35)
Avail: NTIS HC A12/MF A01 CSCL 14B

Polystyrene latex particles have been successfully used as laser velocimetry seed material for flows in the Ames High Reynolds Channels (HR) 1 and 2, the pilot channel, and the one-foot low speed tunnel. These facilities provide test flows with Mach numbers from 0.1 to 3.0 and test section sizes from 4 inches by 6 inches to 18 inches by 24 inches. Tunnel mass flow in the HR-2 channel can approach 1000 lb/sec. The latex particles have the following favorable characteristics: size of 0.35 to 0.55 microns diameter; spherical shape; specific gravity of 1.05; excellent flow trackability; low toxicity; and low cost. they have the disadvantage of being packaged as an aqueous suspension which must be diluted and introduced into the test flow as an atomized mist. This must occur sufficiently far upstream of the test section to minimize flow disturbances and permit the liquid mist to evaporate before reaching the model. Several techniques which have been developed to accomplish satisfactory seeding will be described. Author

N86-11452*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DEVELOPMENT OF SEEDING TECHNIQUES FOR SMALL SUPERSONIC WIND TUNNEL
Warren R. Hingst and Randall M. Chriss (Toledo Univ.) *In* NASA. Langley Research Center Wind Tunnel Seeding Systems for Laser Velocimeters Oct. 1985 p 189-202 refs (For primary document see N86-11437 02-35)
Avail: NTIS HC A12/MF A01 CSCL 14B

The NASA Lewis 1x1 foot supersonic wind tunnel is used to experimentally verify computational methods. This tunnel, which is continuous running, operates from laboratory-wide high pressure air and vacuum systems. As such, the air does not recirculate but makes a single pass through the tunnel. The Mach number is varied with interchangeable nozzle blocks and has a range from Mach 1.6 to 4.0. Dry and filtered air is available up to pressures of 3 atmospheres. The air enters the tunnel system through a plenum having flow straighteners and 6 fine mesh screens. The exit of the plenum provides smooth contraction with an area ratio of approximately 20 that, along with the screens, provides a uniform flow for the nozzle. Author

N86-11453*# Naval Surface Weapons Center, White Oak, Md.
AEROSOL SEEDING SYSTEMS FOR THE NSWC WIND TUNNELS
William J. Yanta, Timothy S. Smith, and Arnold S. Collier *In* NASA. Langley Research Center Wind Tunnel Seeding Systems for Laser Velocimeters Oct. 1985 p 203-210 refs (For primary document see N86-11437 02-35)
Avail: NTIS HC A12/MF A01 CSCL 14B

Four types of laskin nozzles which are used to generate the primary aerosol mist are illustrated. This mist may be used directly as laser doppler velocimeters (LDV) particles. However, in general, a wide range of particle size exists at this stage and requires the use of some type of mono-dispersion refinement technique. These nozzles rely on the shearing action of high speed air near a column of seeding liquid. Typically, olive oil or dioctyl phthalate (DOP) is used, but within the past year solid polystyrene particles in an alcohol suspension have been used with great success. Air, at a typical pressure of five psig, is supplied to the top of the nozzle which is merely a hollow tube. This air issues radially from one or more small jets located near the collar close to the bottom of the tube. When the collar is submerged in the seeding liquid, the hollow columns located in the collar become filled with liquid. The air from the jet shears the liquid into the fine mist. Author

N86-11454*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SEEDING MATERIALS: HEALTH AND SAFETY CONSIDERATIONS
Robert D. Brown *In its* Wind Tunnel Seeding Systems for Laser Velocimeters Oct. 1985 p 211-219 refs (For primary document

see N86-11437 02-35)
Avail: NTIS HC A12/MF A01 CSCL 14B

The choice of a proper seeding material for laser velocimeters must include health and safety considerations. Failure to do so can lead to catastrophic results. All materials are toxic, and laser velocimeter seeding materials are no exception. Toxicity may be considered an inherent property of a given material. The manifestation of that property or the physiological response to the material is dependent on dose and exposure conditions. An approximate physiological classification of toxicity is given in tablular form. Toxicity in some situations is not necessarily the most restrictive factor in selection of materials. It is also very important to consider how the material is used so that actual exposure to the material in a damaging form can result. For example, nickel and cadmium are both extremely toxic as systemic poisons and in the case of nickel as a carcinogen. Seeding materials are dispersed in air under conditions that favor personnel exposure. Dispersal equipment is frequently if not normally manned, and personnel are often required to make frequent adjustments to assure proper operations. Author

N86-11455*# Thermo-Systems, Inc., St. Paul, Minn.
GENERATING AEROSOLS FOR LASER VELOCIMETER SEEDING
Jugal K. Agarwal *In* NASA. Langley Research Center Wind Tunnel Seeding Systems for Laser Velocimeters Oct. 1985 p 221-235 refs (For primary document see N86-11437 02-35)
Avail: NTIS HC A12/MF A01 CSCL 14B

The laser velocimeter (LV) is a unique tool for fluid flow measurements. In such measurements, even though the fluid velocity is of primary interest, the LV signal originates from seed particles present in the fluid and the LV actually measures the velocity of these particles. Thus it is important that a sufficient number of seed particles be present in the fluid and they scatter sufficient light to produce LV signals. Also, the seed particles should follow the fluid with high fidelity. Aerodynamic diameter is the true measure of a particle's ability to follow the flow. The aerodynamic diameter of a particle is defined as the diameter of a unit density sphere with same settling velocity as the particle in question. It is affected by geometric diameter, density and shape of the particle. For LV seeding, particles with smaller aerodynamic diameter are desirable because they follow the flow more readily. On the other hand, in general, the particle's ability to scatter light increases with its geometric diameter and its refractive index.
Author

N86-11456*# Science and Technology Corp., Las Cruces, N. Mex.
PARTICLE PHASE FUNCTION MEASUREMENTS BY A NEW FIBER ARRAY NEPHELOMETER: FAN 1
W. M. Farmer, Edward J. Burlbaw, and A. Deepak (Science and Technology Corp., Hampton, Va.) *In* NASA. Langley Research Center Wind Tunnel Seeding Systems for Laser Velocimeters Oct. 1985 p 237-243 (For primary document see N86-11437 02-35)
Avail: NTIS HC A12/MF A01 CSCL 14B

A fiber array polar nephelometer of advanced design, the FAN I is capable of in-situ phase function measurements of scattered light from man-made or natural atmospheric particles. The scattered light is measured at 100 different angles throughout 360 degrees, thus providing a potential measurement of the asymmetry of irregularly shaped particles. Phase functions can be measured at 10 to 100 Hz rates and the range of measurable single particle sizes is from 5 micron m to as large as 8mm. For particles smaller than 5 micro m the ensemble average can be measured. The FAN I is microprocessor controlled and the data may be stored on floppy disk or printed out in tabular and/or graphical form. The optical head may be separated from the computer system for operation in field or adverse conditions. Examples of laboratory measured scattering phase functions obtained with the FAN I for spherical particles is given to illustrate its measurement capabilities. Author

N86-11457*# Spectron Development Labs., Inc., Costa Mesa, Calif.
A TECHNIQUE TO MEASURE THE SIZE OF PARTICLES IN LASER DOPPLER VELOCIMETRY APPLICATIONS
C. F. Hess *In* NASA. Langley Research Center Wind Tunnel Seeding Systems for Laser Velocimeters Oct. 1985 p 245-264 refs (For primary document see N86-11437 02-35)
Avail: NTIS HC A12/MF A01 CSCL 14B

A method to measure the size of particles in Laser Doppler Velocimeter (LDV) applications is discussed. Since in LDV the velocity of the flow is assocated with the velocity of particles to establish how well they follow the flow, in the present method the interferometric probe volume is surrounded by a larger beam of different polarization or wavelength. The particle size is then measured from the absolute intensity scattered from the large beam by particles crossing the fringes. Experiments using polystrene particles between 1.1 and 3.3 microns and larger glass beads are reported. It is shown that the method has an excellent size resolution and its accuracy is better than 10% for the particle size studied. Author

N86-11458# Little (Arthur D.), Inc., Cambridge, Mass.
SURFACE SAMPLING TECHNIQUES USING ULTRAVIOLET ILLUMINATION Final Report
E. M. Smith, J. R. Aronson, R. M. Cornish, B. E. Goodwin, and I. Simon Nov. 1984 68 p
(Contract DAAK11-83-C-0062)
(AD-A156457; AMXTH-TE-CR-84308) Avail: NTIS HC A04/MF A01 CSCL 19/1

In laboratory and preliminary field tests, a system that uses photography in the presence of a 254 nm UV illumination source has been shown useful for detection of explosives residues on surfaces. Analytes (TNT, 2, 4-DNT, 2, 6-DNT, Tetryl, RDX and DPA) can be detected at 10 to 20 microgram/sq cm on concrete, transite or stainless steel. The method was not successful for wood or brick surfaces or for the analyte PETN. An alternative thermal image radiometric method of detection was unsuccessful.
Author (GRA)

N86-11459# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
FEEDBACK STABILIZATION OF OPTICAL INTERFEROMETER M.S. Thesis
R. H. Nakat Feb. 1985 76 p
(AD-A156912; AFIT/CI/NR-85-41T) Avail: NTIS HC A05/MF A01 CSCL 20/6

An experimental study was carried out on the performance of a feedback stabilization scheme for optical interferometers. Optical interferometers are susceptible to acoustic noise which translates into path length fluctuations in the interferometer arms. These fluctuations induce phase noise, resulting in amplitude fluctuations on the interferometer output. The experiment was performed on a Mach-Zehnder homodyne interferometer where a RMS noise reduction of 23 dB was observed. The stabilization scheme has application to other interferometer configurations. In the future, it will be applied to stabilize cavities used in the squeezed state generation of light. Author (GRA)

N86-11460# Naval Research Lab., Washington, D. C.
SCALING CALCULATIONS FOR A RELATIVISTIC GYROTRON Memorandum Report, Mar. 1984 - Mar. 1985
A. W. Fliflet 31 Jul. 1985 41 p
(RR0-1109)
(AD-A157476; NRL-MR-5598) Avail: NTIS HC A03/MF A01 CSCL 09/1

The relativistic gyrotron is under development as an ultra-high power source of millimeter wave radiation. The purpose of the present study is to estimate the optimum operating characteristics of gyrotrons based on multi-kiloampere, mega-electron volt electron beams. Gyrotrons with weakly relativistic, moderate current electron beams have demonstrated very high efficiency and average power at millimeter wavelengths and the possibility of achieving good efficiencies at very high peak powers is of interest. Compared to other high power millimeter wave generators, gyrotrons are

relatively insensitive to electron beam velocity spread and thus appear well suited to device configurations based on high current pulseline accelerators. The results of this study indicate that the relativistic gyrotron has potential for achieving high efficiency (15-30%) using relativistic electron beams with gamma approx 2-3. Optimum efficiency occurs for short interaction lengths characterized by 4-8 cyclotron periods. Such short interaction lengths lead to the possibility of very high peak power generation using multi-kiloampere beams: 100-300 MW with a 600 ke V beam and about 1 GW with a 1 Me V beam. The output power risetime has been estimated to be a few nanoseconds for a low Q oscillator at 35 GHz which implies the gyrotron interaction can be readily investigated using a 20-100 nsec pulseline accelerator.
Author (GRA)

N86-11461# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
FABRICATION AND USE OF ZIRCALOY/TANTALUM-SHEATHED CLADDING THERMOCOUPLES
S. Curtis Wilkins and L. K. Sepold Jan. 1985 43 p refs
(EGG-TFBP-6739; TI85-009174A) Avail: NTIS HC A03/MF A01

The thermocouples described are zircaloy/tantalum-sheathed and molybdenum/rhenium alloy-sheathed instruments intended for fuel rod cladding and fuel centerline temperature measurements, respectively. Both types incorporate beryllium oxide insulation and tungsten/rhenium alloy thermoelements. These thermocouples, operated at temperatures of 2000 C and above, are developed for use in the internationally sponsored Severe Fuel Damage test series in the Power Burst Facility at the Idaho National Engineering Laboratory. The fabrication steps for both thermocouple types are described in detail. A laser-welding attachment technique for the cladding-type thermocouple is presented, and experience with alternate materials for cladding and fuel thermocouples is discussed. DOE

N86-11462# Mound Lab., Miamisburg, Ohio.
INFRARED THERMOGRAPHY: AN ANALYTICAL TOOL FOR HIGH TEMPERATURE AND FAST RESPONSE
J. H. Mohler, M. D. Kelly, and L. D. Abney 1985 4 p Presented at the AIAA Thermophys. Conf., Williamsburg, Va., 18 Jun. 1985
(Contract DE-AC04-76DP-00053)
(DE85-013826; MLM-3271(OP); CONF-850607-3) Avail: NTIS HC A02/MF A01

The speed and noncontact properties of optical temperature measurements techniques make them particularly useful for studying dynamic, high temperature process. Several examples of the use of video thermography in chemical heat source development are shown. DOE

N86-11463# Sandia Labs., Albuquerque, N. Mex.
GEOTHERMAL INSTRUMENTATION DEVELOPMENT ACTIVITIES AT SANDIA
C. C. Carson Mar. 1985 5 p refs Presented at Intern. Symp. on Geothermal Energy, Kailua Kona, Hawaii, 26 Aug. 1985
(Contract DE-AC04-76DP-00789)
(DE85-008693; SAND-85-0647C; CONF-850801-8) Avail: NTIS HC A02/MF A01

A major element of the geothermal technology development program is directed toward development of instrumentation. This effort has two aspects: the development of high temperature components and prototype tools, and the investigation of new concepts and capabilities. Data acquisition to make geothermal drilling and resource development more efficient is emphasized. Several projects of varying nature and scope make up the instrumentation development element, and the program's emphasis on development of an advanced geothermal drilling system and the need for improved information growth is expanded. DOE

N86-11497*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HOST INSTRUMENTATION R AND D PROGRAM OVERVIEW
D. R. Englund *In its* Turbine Eng. Hot Sect. Technol. (HOST) Oct. 1983 p 7-9 (For primary document see N86-11495 02-39)
Avail: NTIS HC A11/MF A01 CSCL 14B

N86-11498*# United Technologies Research Center, East Hartford, Conn.
HOT SECTION VIEWING SYSTEM
William W. Morey *In* NASA. Lewis Research Center Turbine Eng. Hot Sect. Technol. (HOST) Oct. 1983 p 11-16 (For primary document see N86-11495 02-39)
Avail: NTIS HC A11/MF A01 CSCL 14B

N86-11499*# Pratt and Whitney Aircraft, East Hartford, Conn. Engineering Div.
DYNAMIC GAS TEMPERATURE MEASUREMENT SYSTEM
Denny L. Elmore, Woodrow W. Robinson, and William B. Watkins *In* NASA. Lewis Research Center Turbine Eng. Hot Sect. Technol. (HOST) Oct. 1983 p 17-35 ref (For primary document see N86-11495 02-39)
(Contract NAS3-23154)
Avail: NTIS HC A11/MF A01 CSCL 14B

N86-11500*# United Technologies Research Center, East Hartford, Conn.
HIGH TEMPERATURE STATIC STRAIN SENSOR DEVELOPMENT PROGRAM
Charles Hulse, Richard Bailey, and Howard Grant (Pratt and Whitney Aircraft Group, East Hartford, Conn.) *In* NASA. Lewis Research Center Turbine Eng. Hot Sect. Technol. (HOST) Oct. 1983 p 37-40 (For primary document see N86-11495 02-39)
(Contract NAS3-23722)
Avail: NTIS HC A11/MF A01 CSCL 14B

N86-11502*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Engineering Div.
DEVELOPMENT OF HEAT FLUX SENSORS FOR TURBINE AIRFOILS AND COMBUSTOR LINERS
William H. Atkinson *In* NASA. Lewis Research Center Turbine Eng. Hot Sect. Technol. (HOST) Oct. 1983 p 45-55 ref (For primary document see N86-11495 02-39)
Avail: NTIS HC A11/MF A01 CSCL 14B

N86-11504*# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Chemical Engineering.
TIME-OF-FLIGHT ANEMOMETER FOR HOT SECTION APPLICATIONS
Robert V. Edwards *In* NASA. Lewis Research Center Turbine Eng. Hot Sect. Technol. (HOST) Oct. 1983 p 69-71 (For primary document see N86-11495 02-39)
Avail: NTIS HC A11/MF A01 CSCL 14B

N86-11880# California Univ., Livermore. Lawrence Livermore Lab. Field Test Systems Div.
PHOTOELECTRON TRAJECTORY ANALYSES OF STREAK TUBES Abstract Only
Ching C. Lai *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 53 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

N86-11563# Technische Hochschule, Darmstadt (West Germany). Inst. fuer Physikalische Geodaesie.
MODIFICATION OF A HUGHES TILTMETER TO A BOREHOLE TILTMETER
C. Gerstenecker *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth 1985 p 142-149 refs (For primary document see N86-11549 02-42)
Avail: NTIS HC A09/MF A01

N86-11577# Hungarian Academy of Sciences, Sopron. Geodetical and Geophysical Research Inst.
CAPACITIVE PENDULUM WITH INTELLIGENT DATA COLLECTION
Gy. Mentes *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 2 1985

p 63-69 refs (For primary document see N86-11568 02-42)
Avail: NTIS HC A09/MF A01

N86-11583# Academy of Sciences, Potsdam (East Germany). Zentralinst. fuer Physik der Erde.
ON THE COMPARISON OF THE RESULTS OF TWO DIFFERENT E-W-STRAINMETERS
D. Simon, R. M. Karmaleeva (Academy of Sciences (USSR), Moscow), and L. A. Latynina (Academy of Sciences (USSR), Moscow) *In its* Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 2 1985 p 115-125 refs (For primary document see N86-11568 02-42)
Avail: NTIS HC A09/MF A01

N86-11614# Hungarian Academy of Sciences, Sopron. Geodetic and Geophysical Research Inst.
A NEW APPARATUS FOR TESTING BUBBLE VIALS, ELECTRONIC LEVELS AND AUTOMATIC LEVELS
J. Somogyi, K. Krausz, and Gy. Mentes *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 140-147 refs (For primary document see N86-11591 02-42)
Avail: NTIS HC A08/MF A01

N86-11981# Joint Publications Research Service, Arlington, Va.
EXPERIMENTAL INVESTIGATION OF RECORDING OF DYNAMIC HOLOGRAMS WITHIN ABSORPTION CONTOUR OF RESONANT ATOMIC MEDIUM Abstract Only.
A. Ye. Korolev and D. I. Staselko *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 86 refs Transl. into ENGLISH from Opt. i Spektrosk. (Leningrad), v. 58, no. 1, Jan. 1985 p 147-152 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

N86-11982# Joint Publications Research Service, Arlington, Va.
DIFFRACTION EFFICIENCY OF THREE-DIMENSIONAL PHASE HOLOGRAM OF DIFFUSE OBJECT Abstract Only
Yu. L. Korzinin and V. L. Sukhanov *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 87 refs Transl. into ENGLISH from Opt. i. Spektrosk. (Leningrad), v. 58, no. 1, Jan. 1985 p 142-146 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

N86-11983# Joint Publications Research Service, Arlington, Va.
POSSIBILITY OF OPTIMAL CHOICE OF EXPOSURE TIME FOR HOLOGRAPHIC RECORDING OF OBJECTS THROUGH UNSTEADY SCATTERING MEDIA Abstract Only.
O. V. Angelskiy, V. V. Yatsenko, and D. I. Derkach *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 89 refs Transl. into ENGLISH from Zh. Prikl. Spektrosk. (Minsk, USSR), v. 42, no. 1, Jan. 1985 p 118-122 Original language doc. was announced as A85-28983 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

36 LASERS AND MASERS

Includes parametric amplifiers.

N86-11464 Illinois Univ., Urbana-Champaign.
OPERATING RANGE OF ALUMINUM GALLIUM ARSENIDE QUANTUM-WELL HETEROSTRUCTURE LASERS: TUNABILITY, POWER OUTPUT AND HIGH ENERGY EMISSION Ph.D. Thesis
John Edward Epler 1985 99 p
Avail: Univ. Microfilms Order No. DA8511604

A quantum-well heterostructure (QWH) is the most capable form of semiconductor laser. The quantum-size effect (QSE), inherent in a QWH laser, improves the device performance compared to conventional double heterostructure lasers. One advantage provided by the QSE is the increased possibility for carrier bandfilling of the active region. Experimental results are presented in which the continuous (CW) emission wavelength of an A1(x)Ga(1-x)AsGaAs QWH laser diode is tuned over a 100-meV spectral range (with the aid of an external grating cavity). The single 90-A quantum well is an ideal active region to provide broadband (7800-8300) optical gain. To extend the power output, a QWH laser with a multiple-stripe active region is also operated in the external grating cavity. The short wavelength, high performance diodes with a single 400-AA1(x)Ga(1-x)As (x approx. 0.22) quantum-well active region region exhibit less tunability but a much greater power output than single stripe lasers fabricated on the same crystal. The trade-off between power output and tunability is discussed. Dissert. Abstr.

N86-11465*# Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.
[CHARACTERISTICS OF AN AXISYMMETRIC SUDDEN EXPANSION FLOW] Progress Report, 1 Jul. 1984 - 1 Jul. 1985
W. H. Stevenson and H. D. Thompson 1 Jul. 1985 17 p refs (Grant NAG3-502)
(NASA-CR-176278; NAS 1.26:176278) Avail: NTIS HC A02/MF A01 CSCL 20E

A two-color, two component Laser Doppler Velocimeter (LDV) system operating in forward scatter has been developed in order to make simultaneous measurements of the axial and radial velocity components in an axisymmetric sudden expansion flow with and without combustion. The LDV system includes Bragg cell modulators in the four beam paths to allow a net frequency shift of 5MHz in both the green and blue beams. This permits an unambiguous measurement of negative velocities and also eliminates incomplete signal bias. The green beam probe volume has a waist diameter of 0.200 mm and is approximately 2mm long. The blue beam has a probe volume waist of 0.250 mm and is approximately 1 mm long. The scattered light from the probe volume is separated so that approximately 80% of each color passes to its respective photomultiplier tube by using a dichroic filter. Narrow bandpass filters are used to further filter unwanted signals before they are detected. A schematic diagram of the LDV system is shown. Author

N86-11466# Westinghouse Research and Development Center, Pittsburgh, Pa.
MERCURY BROMIDE RECONSTITUTION IN THE HgBr LASER SYSTEM Final Report, 15 May 1983 - 15 Jun. 1984
C. S. Liu 11 Sep. 1984 22 p
(Contract N00014-83-C-0375)
(AD-A156502) Avail: NTIS HC A02/MF A01 CSCL 20/5

The major effort was to perform experimental life studies of an UV pre-ionized mercury bromide laser and reconstitute the reaction products such as Hg and Hg2Br2. During past years, we had conducted extensive experimental lifetime studies of a small scale HgBr laser. From these experiments, we selected suitable materials for laser construction, developed procedures to fabricate and fill the laser tube, and finally, we lifetested the laser for over 5 million shots. Those results indicate that pinhole-free gold plated nickel is chemically inert to the HgBr2 discharge and can be used for constructing long-lived high prf HgBr lasers. However, for a large system its is difficult to plate the base metal with pinhole free gold. It is this motivation for developing a HgBr2 recovery system. In this report, we describe the construction of a long-lived, high prf HgBr laser with a built-in HgBr2 reconstitution system and present experimental test data which confirm our theoretical predictions. Finally we recommend the future design of a practical 10 to the 10th power shots HgBr laser. GRA

N86-11467# Georgia Tech Research Inst., Atlanta.
PHOTON INDUCED ELECTRON ATTACHMENT Final Report, May 1982 - Nov. 1984
F. L. Eisele Wright-Patterson AFB, Ohio AFWAL Dec. 1984 64 p
(Contract F33615-82-C-2202)
(AD-A156506; AFWAL-TR-85-2015) Avail: NTIS

HC A04/MF A01 CSCL 07/5

Measurements were performed to determine the feasibility of infrared excitation of the molecules Nitrogen Fluoride, Carbon Fluoride, Carbon Dioxide, Hydrogen Chloride, and Hydrogen Cyanide to an excited state with an enhanced electron attachment rate. The former three molecules were optical pumped by a CO2 laser but no enhanced attachment was observed at any of the laser lines available. The HCl v = zero to two transition was directly pumped by optically mixing of 1.06 micron radiation from a Neodymium : YAG laser with the output of a Yttrium Aluminum Garnet pumped dye laser at .660 microns. Little or no enhanced attachment was observed suggesting a dissociative electron attachment cross section of less than 10 to the -15th power sq. cm. for HCl(v=2). A similar technique was used to excite HCN(v=2) but no enhanced electron attachment was observed. GRA

N86-11468# Oak Ridge National Lab., Tenn.
MELTING OF CRYSTALLINE AND AMORPHOUS SILICON BY RUBY, XeCl AND KrF LASER IRRADIATION
M. J. Aziz, C. W. White, J. Narayan, and B. Stritzker Jun. 1985 7 p Presented at the Mater. Res. Soc. Europe Conf., Strasbourg, 13 May 1985
(Contract DE-AC05-84OR-21400)
(DE85-015040; CONF-8505184-1) Avail: NTIS HC A02/MF A01

Depths of melting in crystalline Si were measured by TEM observations of the removal of dislocation loops created by low dose ion implanting. Depths of melting of amorphous Si layers were monitored by observing the boundaries between a large polycrystalline region, assumed to form by normal melting from and resolidification back to the free surface, and a fine polycrystalline region, assumed to form by the explosive propagation inward of a thin buried liquid layer. The comparison or predictions of heat flow calculations to the measured depth of melting in both crystalline and amorphous silicon are reported. Excellent agreement is found with the Ruby and the XeCl results. Reasonable agreement with the KrF results is obtained only if the silicon liquid phase reflectivity at 249 nm is significantly less than that obtained by extrapolation of the optical parameters from longer wavelengths. DOE

N86-11469# Stanford Univ., Calif. Dept. of Applied Physics.
IMPROVED SOLID STATE LASER SOURCES, VOLUME 3 Final Report
R. I. Dyer and R. C. Eckardt Apr. 1985 17 p
(Contract W-7405-eng-48)
(DE85-012956; UCRL-15561-Vol-3) Avail: NTIS HC A02/MF A01

Investigations have been performed in several areas of solid state laser development. Research in slab-lasers has resulted in a theory of thermal effects and optical propagation which has allowed scaling to larger slabs and extention of the slab concept to crystalline laser hosts. Study of nonlinear optical materials has been extended to include AgGaSe2 and Nd:MgO:LiNbO3. AgGaSe2 is useful for nonlinear frequency conversion in the infrared out to 17 microns. Nd:MgO:LiNbO3 allows a single crystal to be used simultaneously as both active laser material and nonlinear optical or modulator material. A single crystal fiber growth station is developed which has potential application in material surveys by the rapid growth of small samples of crystalline laser materials for spectroscopic evaluation. These research activities combined with other current research programs form a coordinated effort which has resulted in several significant advances in laser development and nonlinear optics. DOE

N86-11470# Sandia Labs., Albuquerque, N. Mex.
VELOCITY MEASUREMENTS OF LASER DRIVEN FLYERS BACKED BY HIGH IMPEDANCE WINDOWS
S. A. Sheffield, J. W. Rogers, Jr., and J. N. Castaneda 1985 13 p Presented at the Am. Phys. Soc. Topical Conf. on Shock Waves in Condensed Matter, Spokane, 22 Jul. 1985
(Contract DE-AC04-76DP-00789)
(DE85-015142; SAND-85-12350; CONF-850736-30) Avail: NTIS HC A02/MF A01

The response of free-standing foils to laser intensity levels of 1,000 to 1,000000 Gw/sq cm was characterized. The response of free-standing and backed foils at much lower intensities, i.e., in the region of 1 to 20 GW/sq cm, was characterized and these flyers are used to initiate insensitive secondary high explosives. The output of a 3.5-J Nd:glass laser with a 16 ns pulse was used to drive 1.5-mm-diameter aluminum flyers. The velocities of both free-standing flyers and flyers backed on the driven side by windows of water, fused silica, or sapphire were measured using optically recording velocity interferometer system (ORVIS). Intensities were on the order of 10 GW/sq cm and velocities as high as 5 km/s were measured for 13-micron/thick, Al flyers. Velocity and acceleration varied only slightly with the shock impedance of the window. Preliminary measurements indicate that pentaerythritol tetranitrate (PETN) at a density of 1.4 grams/cu cm, and HNS-FP (hexanitrostilbene-fine particle) at a density of 1.6 grams/cu cm, can be promptly detonated by 66-micron m-thick, Al flyers impacting at a velocity of near 2.5 km/s. DOE

N86-11471# California Univ., Livermore. Lawrence Livermore Lab.
SPECTRALLY-BROAD PICOSECOND LIGHT SOURCE
M. D. Rotter 18 Jul. 1985 5 p refs Presented at the SPIE Intern. Tech. Symp. on Optical and Elec.-Optical Eng., San Diego, Calif., 18 Aug. 1985
(Contract W-7405-eng-48)
(DE85-015177; UCRL-92170; CONF-850887-10) Avail: NTIS HC A02/MF A01

A fast (35 ps or less), spectrally broad (at least 600 nm) light source for use in characterizing and calibrating photonics equipment is described. The spectral output of the source is described, and examples of its use are given. DOE

N86-11503*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LASER ANEMOMETRY FOR HOT SECTION APPLICATIONS
Richard G. Seasholtz, Lawrence G. Oberle, and Donald H. Weikle *In its* Turbine Eng. Hot Sect. Technol (HOST) Oct. 1983 p 57-67 refs (For primary document see N86-11495 02-39)
Avail: NTIS HC A11/MF A01 CSCL 20E

N86-11861# Los Alamos National Lab., N. Mex. Engineering Analysis Section.
DESIGN OPTIMIZATION OF THE POWER GENERATION SYSTEM FOR A SPACE-BASED FREE-ELECTRON LASER Abstract Only
Norman M. Schnurr *In its* 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 10 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

N86-11877# California Univ., Livermore. Lawrence Livermore Lab. Nuclear Test Engineering Div.
THERMO-MECHANICAL ANALYSES OF LASER-HEATED SURFACES Abstract Only
Gary L. Johnson *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 44 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

N86-11955# Joint Publications Research Service, Arlington, Va.
TOWARD A THEORY OF ATOMIC GAS BREAKDOWN BY LASER RADIATION NEAR A METAL SURFACE Abstract Only
V. S. Vorobev and A. L. Khomkin *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 13 refs Transl. into ENGLISH from Fiz. Plazmy (Moscow), v. 10, no. 5, Sep. - Oct. 1984 p 1025-1032 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

N86-11957# Joint Publications Research Service, Arlington, Va.
LASER EVAPORATION OF METAL IN GASEOUS ATMOSPHERE Abstract Only
V. I. Igoshin and V. I. Kurochkin *In its* USSR Rept.: Phys. and

Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 15 refs Transl. into ENGLISH from Kvantovaya Elektron. (Moscow), v. 11, no. 8, Aug. 1984 p 1555-1561 Previously announced in IAA as A85-19247 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

N86-11961# Joint Publications Research Service, Arlington, Va.
EXCITATION OF DISCHARGE IN AIR BY LASER RADIATION Abstract Only
V. I. Bukatyy, A. A. Kobolov, and A. A. Telnikhin *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 27 refs Transl. into ENGLISH from Zh. Tekhn. Fiz. (Leningrad), v. 55, no. 2, Feb. 1985 p 312-318 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

N86-11967# Joint Publications Research Service, Arlington, Va.
LASING ON VAPORS OF CHAIN COMPOUNDS Abstract Only
V. V. Gruzinskiy, K. M. Degtyarenko, T. N. Kopylova, and V. T. Pavlova *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 44 p 44 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved.: Fiz. (Tomsk, USSR), v. 28, no. 1, Jan. 1985 p 101-103 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

N86-11968# Joint Publications Research Service, Arlington, Va.
ENERGY CHARACTERISTICS OF LASER WITH SATURABLE ANISOTROPIC ABSORBING MEDIUM IN CAVITY Abstract Only
A. P. Voytovich and V. V. Mashko *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 44-45 refs Transl. into ENGLISH from Zh. Prikl. Spektros. (Minsk, USSR), v. 41, no. 6, Dec. 1984 p 899-904 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

N86-11969# Joint Publications Research Service, Arlington, Va.
INVESTIGATION OF EFFICIENCY OF GENERATION OF DIFFERENCE-FREQUENCY LASER RADIATION IN WAVEGUIDE Abstract Only
A. O. Makaryan, K. M. Movsisyan, and P. S. Pogosyan *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 45 Transl. into ENGLISH from Zh. Prikl. Spektros. (Minsk, USSR), v. 41, no. 6, Dec. 1984 p 908-911 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

N86-11970# Joint Publications Research Service, Arlington, Va.
SPECTRUM STRUCTURE OF XeCl ELECTRIC DISCHARGE LASER Abstract Only
V. S. Burakov, A. F. Bokhonov, and V. A. Titarchuk *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 46 Transl. into ENGLISH from Zh. Prikl. Spektros. (Minsk, USSR), v. 41, no. 6, Dec. 1984 p 1029-1032 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

N86-11971# Joint Publications Research Service, Arlington, Va.
DISTRIBUTED-FEEDBACK LASERS WITH ACTIVE FRAMING MEDIUM Abstract Only
Yu. N. Ryzhov, I. V. Cheremiskin, and T. K. Chekhlova *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 47 refs Transl. into ENGLISH from Zh. Prikl. Spektros. (Minsk, USSR), v. 42, no. 1, Jan. 1985 p 48-51 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

N86-11972# Joint Publications Research Service, Arlington, Va.
INVESTIGATION OF POLARIZATION CHARACTERISTICS OF RADIATION FROM LASER WITH DYE-ACTIVATED POLYMER ELEMENTS Abstract Only
V. S. Burakova, N. N. Vasilev, A. Ya. Gorelenko, V. Ye. Sivenkova, and A. P. Shkadarevich *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 48 refs Transl. into ENGLISH from Zh. Prikl. Spektros. (Minsk, USSR), v. 42, no. 1, Jan. 1985 p 35-40 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

N86-11973# Joint Publications Research Service, Arlington, Va.
HIGH-EFFICIENCY Al SUB 2 O SUB 3:Ti SUP 3+ TUNABLE LASER Abstract Only
G. S. Kruglik, G. A. Skripko, A. P. Shkadarevich, N. V. Kondratyuk, E. A. Zhdanov, and A. M. Zabaznov *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 48-49 refs Transl. into ENGLISH from Zh. Prikl. Spektros. (Minsk, USSR), v. 42, no. 1, Jan. 1985 p 126-128 Original language doc. was announced at A85-28984 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

N86-11974# Joint Publications Research Service, Arlington, Va.
ULTRAVIOLET LASING IN HELIUM-NITROGREN MIXTURES Abstract Only
E. I. Asinovskiy, L. M. Vasilyak, V. V. Markovets, and Yu. M. Tokunov *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 49 refs Transl. into ENGLISH from Zh. Prikl. Spektros. (Minsk, USSR), v. 42, no. 1, Jan. 1985 p 131-134 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

N86-11975# Joint Publications Research Service, Arlington, Va.
ELECTROIONIZATION IR Xe-ATOM LASER Abstract Only
N. G. Basov, V. A. Danilychev, A. Yu. Dudin, D. A. Zayarnyy, N. N. Ustinovskiy, I. V. Kholin, and A. Yu. Chugunov *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 49-50 refs Transl. into ENGLISH from Kvantovaya Elektronika (Moscow), v. 11, no. 9, Sep. 1984 p 1722-1736 Original language doc. was announced as A85-21003 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

N86-11976# Joint Publications Research Service, Arlington, Va.
OPTIMIZATION OF PARAMETERS OF CHEMICAL CO LASER BY INCREASING LENGTH OF ACTIVE MEDIUM Abstract Only
V. A. Dudkin and V. B. Rukhin *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 51 refs Transl. into ENGLISH from Kvantovaya Elektronika (Moscow), v. 11, no. 9, Sep. 1984 p 1883-1884 Original language doc. was announced at A85-21013 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

N86-11977# Joint Publications Research Service, Arlington, Va.
EFFICIENCY OF OPTICALLY-PUMPED XeF-LASER Abstract Only
V. S. Zuyev, L. D. Mikheyev, and D. B. Stavrovskiy *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 55 refs Transl. into ENGLISH from Kvantovaya Elektronika (Moscow), v. 11, no. 9, Sep. 1984 p 1750-1756 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

N86-11978# Joint Publications Research Service, Arlington, Va.
ENERGY CHARACTERISTICS OF WAVEGUIDE CO SUB 2-LASER Abstract Only
Yu. B. Konev, N. I. Lipatov, P. P. Pashinin, and A. M. Prokhorov *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 59-60 refs Transl. into ENGLISH from Kvantovaya Elektron. (Moscow), v. 11, no. 8, Aug. 84 p 1641-1645 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

N86-11979# Joint Publications Research Service, Arlington, Va.
CHROMIUM- AND NEODYMIUM-ACTIVATED GADOLINIUM-SCANDIUM-GALLIUM GARNET CRYSTAL: A NEW LASER ACTIVE MEDIUM
Ye. V. Zarikov, V. V. Yaptev, V. G. Ostroumov, Yu. S. Privos, V. A. Smirnov, and I. A. Shcherbakov *In its* USSR Rept.: Phys. and

Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 61 refs Transl. into ENGLISH from Kvantovaya Elektronika (Moscow), v. 11, no. 8, Aug. 1984 p. 1565-1574 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

N86-11980# Joint Publications Research Service, Arlington, Va.
TWO-FREQUENCY PASSIVE MODE LOCKING IN IODINE PHOTODISSOCIATION LASER Abstract Only
V. M. Kiselev, A. S Grenishin, T. N. Kotlikova, and L. I. Rodina *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 61-62 p 61-62 refs Transl. into ENGLISH from Kvantovaya Elektron. (Moscow), v. 11, no. 8, Aug. 1984 p 1542-1554 Previously announced in IAA as A85-19246 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

N86-11928# Joint Publications Research Service, Arlington, Va.
FREQUENCY-SELECTION AND MODE-LOCKING AND Nd:YAG LASER Abstract Only
Guichen Tan and Peixia Qiu *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-014) 2 May 1985 p 80 Transl. into ENGLISH from Zhongguo Jiguang (Shanghai), v. 12, no. 1, 20 Jan. 1985 p 11-14 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

N86-11929# Joint Publications Research Service, Arlington, Va.
A LARGE AREA X-RAY SOURCE AND ITS PREIONIZATION CHARACTERISTICS FOR XeCl EXCIMER LASER Abstract Only
Qihong Lou, Runwen Wang, and Xusan Cheng *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-014) 2 May 1985 p 81 Transl. into ENGLISH from Zhongguo Jiguang (Shanghai), v. 12, no. 1, 20 Jan. 1985 p 19-21 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

N86-11930# Joint Publications Research Service, Arlington, Va.
RING CAVITY CO2 LASER FOR BRANCH-SELECTION AND NARROW RESONANCE PRODUCED BY SF6 IN CAVITY Abstract Only
Yongkai Huang and Jianmin Rong *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-014) 2 May 1985 p 82 Transl. into ENGLISH from Zhongguo Jiguang (Shanghai), v. 12, no. 1, 20 Jan. 1985 p 25-28 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

N86-11933# Joint Publications Research Service, Arlington, Va.
STATIONARY PULSE SOLUTIONS FOR A FREE ELECTRON LASER Abstract Only
Honglie Fang, Shufen Fu, and G. T. Moore *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-014) 2 May 1985 p 88 Transl. into ENGLISH from Wuli Xuebao (Beijing), v. 33, no. 7, Jul. 1984 p 935-942 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

N86-12003# Joint Publications Research Service, Arlington, Va.
DOUBLE-WAVELENGTH PULSED TUNABLE DYE LASER Abstract Only
Zaixuan Zhang, Jingyun Wang, Yiqian Yuan et al *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-015) 16 May 1985 p 97 Transl. into ENGLISH from Zhongguo Jiguang (Shanghai), v. 11, no. 6, 20 Jun. 1984 p 323-326 (For primary document see N86-11994 02-70)
Avail: NTIS HC A07/MF A01

N86-12006# Joint Publications Research Service, Arlington, Va.
ON CONVECTIVE EFFECTS IN GAS LASERS Abstract Only
Zhi Gao *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-015) 16 May 1985 p 116 Transl. into ENGLISH from Wuli Xuebao (Beijing), v. 33, no. 9, Sep. 1984 p 1294-1300 (For primary document see N86-11994 02-70)
Avail: NTIS HC A07/MF A01

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N86-11472 Texas Univ., Austin.
NUMERICAL SOLUTION FOR CONTACT PRESSURE AND WEAR DISTRIBUTIONS OF UNLUBRICATED, MISALIGNED, CLOSELY CONFORMING, MULTIPLY CONNECTED SURFACES Ph.D. Thesis
Hsien Heng Chen 1984 239 p
Avail: Univ. Microfilms Order No. DA8513195

A general numerical method is presented for studying unlubricated arbitrary profile, elastic body contact problems with combined normal and shear loadings. A pressure wear theory is introduced to solve for instantaneous pressure distributions and the corresponding worn surface profiles as sliding contact continues. The modified Boussinesq point force displacement influence function and modified profile function are employed in conjunction with an integral equation discretization method and an automatic mesh generation technique to redefine the new pressure area boundary. A wide range of contact problems involving multiply connected regions can be solved. The general numerical method has been implemented in several computer programs and has been applied to the problems of misaligned and perfectly-aligned contact. The resuits have been verified by comparison with the experimental data presented in the literature for the self-lubricated journal bearing under various conditions of load and misalignment. Dissert. Abstr.

N86-11473*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A COMPARISON OF THE PHYSICS OF GAS TUNGSTEN ARC WELDING (GTAW), ELECTRON BEAM WELDING (EBW), AND LASER BEAM WELDING (LBW)
A. C. Nunes, Jr. Aug. 1985 22 p refs
(NASA-TM-86503; NAS 1.15:86503) Avail: NTIS HC A02/MF A01 CSCL 13H

The physics governing the applicability and limitations of gas tungsten arc (GTA), electron beam (EB), and laser beam (LB) welding are compared. An appendix on the selection of laser welding systems is included. Author

N86-11474*# Pratt and Whitney Aircraft, East Hartford, Conn. Engineering Div.
LATERAL DAMPERS FOR THRUST BEARINGS Final Report
D. H. Hibner and D. R. Szafir Aug. 1985 79 p refs
(Contract NAS3-23932)
(NASA-CR-174924; NAS 1.26:174924; PWA-5966-17) Avail: NTIS HC A05/MF A01 CSCL 13I

The development of lateral damping schemes for thrust bearings was examined, ranking their applicability to various engine classes, selecting the best concept for each engine class and performing an in-depth evaluation. Five major engine classes were considered: large transport, military, small general aviation, turboshaft, and non-manrated. Damper concepts developed for evaluation were: curved beam, constrained and unconstrained elastomer, hybrid boost bearing, hydraulic thrust piston, conical squeeze film, and rolling element thrust face. Author

N86-11475*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PROTECTIVE COATINGS OF METAL SURFACES BY COLD PLASMA TREATMENT
R. Manory and A. Grill (Ben Gurion Univ. of the Negev, Beer Sheva) Oct. 1985 15 p refs
(NASA-TM-87152; E-2747-1; NAS 1.15:87152) Avail: NTIS HC A02/MF A01 CSCL 11F

The cold plasma techniques for deposition of various types of protective coatings are reviewed. The main advantage of these techniques for deposition of ceramic films is the lower process temperature, which enables heat treating of the metal prior to deposition. In the field of surface hardening of steel, significant reduction of treatment time and energy consumption were obtained.

A simple model for the plasma - surface reactions in a cold plasma system is presented, and the plasma deposition techniques are discussed in view of this model. Author

N86-11476# California Univ., Livermore. Lawrence Livermore Lab.
SURFACE PROPERTIES OF SHOCKED LEAD
R. Couch, L. Shaw, R. Barlett, L. Steinmetz, w. Behrendt, and C. Firpo Mar. 1985 11 p Presented at the Intern. Conf. on Mech. and Phys. Behaviour of Mater. Under Dyn. Loading, Paris, 2 Sep. 1985
(Contract W-7405-eng-48)
(DE85-009582; UCRL-90817; CONF-850946-2) Avail: NTIS HC A02/MF A01

Hydrodynamic experiments often require optical observation of shocked surfaces. However, phenomena that alter surface appearance can obscure the interpretation of data. Studies of material ejection were extended to include more complicated shock structures. In addition, both thin foils and an imposed atmosphere were used as ways of sampling the surface in search for nonhomogeneous behavior. Quantitative measures of mass ejection were obtained using X-ray transmission analysis, and high speed photography, provided qualitative data. Results indicate that the amount of mass ejected is a function of shock structure. Many heterogeneous effects are observed that are presumed to be related to surface preparation, partial melting, and spall. DOE

N86-11477# Oak Ridge National Lab., Tenn.
REFRACTORY ALLOY PERFORMANCE: PRODUCT FORM PROCUREMENT AND COMPONENT FABRICATION
W. O. Harms 1985 17 p Presented at the SP-100 Systems Selection Comm. Rev. on Fuels and Mater. Conf., Los Alamos, N. Mex., 20 Jun. 1985
(Contract DE-AC05-84OR-21400)
(DE85-014658; CONF-8506153-2) Avail: NTIS HC A02/MF A01

The availability and fabricability of welded components of candidate refractory alloys is presented. Listed is the commercial facilities, procedures, properties of weldments and postweld heat treatments. E.R.

N86-11478# Honeywell, Inc., Roseville, Minn.
HERMETIC BELLOWS SEAL FOR BRAUN LINEAR ENGINE: DESIGN, TEST AND DEMONSTRATION Final Report
Jun. 1985 26 p Prepared in cooperation with Tectonics Research Inc., Roseville, Minn.
(Contract DE-AC05-87OR-21400)
(DE85-013545; ORNL/Sub-80-61613/1) Avail: NTIS HC A03/MF A01

Seal requirements were defined, seal performance to develop a design data base were analyzed and the design criteria to evolve a seal solution suitable for application to a light commercial sized heat pump was applied. Maximum life goal is 15 years with operation of at least 4000 hours per year. The seal will be exposed to an oil/refringement mixture on one side and atmosphere contaminated with combustion products on the other side. The evolved seal design consists of two or more bellows elements placed in series and joined to the underface of the piston at one end and to the crankcase at the other. The intermediary ends of the bellows are joined together so that all the joints are made leak tight. The compressor piston rod is enclosed within the bellows. Bellows elements are driven at their point of junction by a mechanism synchronized to the piston motion but so constrained as to limit the stress in each element, thereby insuring an effective, long life hermetic seal. E.A.K.

N86-11479# Sandia Labs., Albuquerque, N. Mex.
DISH ELECTRIC SYSTEMS HEAT ENGINE ASSESSMENT
L. L. Lukens Jun. 1985 44 p
(Contract DE-AC04-76DP-00789)
(DE85-013942; SAND-85-0522) Avail: NTIS HC A03/MF A01

Cost and performance estimates of several heat engine technologies were studied and their performance was evaluated with a dish electric system model. The analysis yielded the relative potential of the different heat engine technologies to meet the National Solar Thermal Technology program goal for levelized electricity cost. The heat engines evaluated were the Brayton engine, the Rankine engine the liquid metal thermoelectric converter, the Stirling engine, and two binary engines. It is indicated that the liquid metal thermoelectric converter, the Stirling engines, and the binary engines have the highest potential for cost effective dish electric systems. DOE

N86-11480# National Coal Board, Grimethorpe (England).
EVALUATION OF CANDIDATE MATERIALS IN A STATIC TURBINE CASCADE
Jun. 1985 266 p
(Contract DE-AI01-76ET-10393)
(DE85-008592; DOE/ET-10393/1859) Avail: NTIS HC A12/MF A01

A range of materials in a static cascade was evaluated. Some of these materials are considered for the manufacturing of blades for a gas turbine powered by a pressurized fluidized bed combustor. The cascade consisted of five stages of specimens. The first three stages consisted of nine impulse aerofoils, which turned the flow but did not accelerate it. The fourth stage was made up of nine reaction blades which both turned the flow and accelerated it to near sonic velocity, whereupon the flow entered the fifth stage which consisted of three erosion targets. Details of the exposure conditions and the results of the examinations of the specimens are presented. No evidence was found of erosion of the blades by particles of entrained dust; however, there was evidence of Type II, low temperature, hot corrosion on many of the specimens. DOE

N86-11481# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
ECONOMIC EVALUATION OF CONCURRENT WELDING AND NONDESTRUCTIVE EXAMINATION
A. D. Watkins, J. A. Johnson, and H. B. Smartt 1985 20 p Presented at the 66th Am. Welding Soc. Ann. Meeting, Las Vegas, Nev., 28 Apr. 1985
(Contract DE-AC07-76ID-01570)
(DE85-014623; EGG-M-17884; CONF-8504102-3) Avail: NTIS HC A02/MF A01

The cost savings of implementing the concurrent welding and nondestructive examination technique, for a proposed welding operation, to be $73.26 per meter of weld are estimated. A hypothetical weld operation was developed using standard data from nonrepetitive work measuring programs. Proposed changes to this weld operation to implement the concurrent welding and nondestructive examination are analyzed by comparing between the proposed and hypothetical weld operation. Standard methods are used to calculate the cost savings between the sequential differences of the two weld operations. DOE

N86-11482# Argonne National Lab., Ill.
NUMERICAL SIMULATION OF AN EQUIPMENT HATCH FOR A STEEL CONTAINMENT VESSEL TO LOADING BEYOND THE DESIGN BASIS
R. F. Kulak, B. J. Hsieh, J. E. Ash, J. M. Kennedy, and G. A. McLennan 1985 13 p refs Presented at the 8th Intern. Conf. on Struct. Mech. in Reactor Technol., Brussels, 19 Aug. 1985
(Contract W-31-109-eng-38)
(DE85-010485; CONF-850809-56) Avail: NTIS HC A02/MF A01

The sealing deformations of a large equipment hatch with a pressure seated gasket due to overpressurization were analyzed. An axisymmetric finite element analysis of the penetration sleeve revealed that its surface can undergo large rotations. Values for sealing surface rotation of 7 deg were computed. The order of magnitude of leakage due to the sealing surface rotation is estimated. DOE

N86-11483# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
ADVANCED MECHANICAL HEAT PUMP TECHNOLOGIES FOR INDUSTRIAL APPLICATIONS

J. I. Mills, D. S. Plaster, and R. N. Chappell 1985 9 p refs Presented at the 7th Ann. Ind. Energy Technol. Conf., Houston, Tex., 13 May 1985 Prepared in cooperation with DOE, Idaho Falls, Idaho
(Contract DE-AC07-76ID-01570)
(DE85-014613; EGG-M-28384; CONF-850515-2) Avail: NTIS HC A02/MF A01

Advanced chemical and mechanical heat pump technologies were developed for industrial application. Five advanced mechanical heat pump technologies are at various stages of stepped development strategy including: (1) a waste heat powered steam compression system; (2) a high temperature reverse Rankine cycle heat pump with methanol working fluid; (3) a Brayton cycle solvent recovery system; (4) magnetic cycle heat pumps; and (5) Stirling cycle heat pumps. These five advanced mechanical heat pump systems and how the development strategy allows efficient progression from concept to technology transfer to the private sector is discussed. Results are beneficial in determining how various steps of the product development plan should proceed. The results of ongoing work will determine applications suitable for industrial heat pumps and will further guide the development of advanced technologies. DOE

N86-11484# Brookhaven National Lab., Upton, N. Y.
OPTIMIZED GROUND-COUPLED HEAT PUMP SYSTEM DESIGN FOR NORTHERN CLIMATE
M. A. Catan and V. D. Baxter (ORNL) 1985 29 p refs Presented at Am. Soc. of Heating, Refrigerating and Air-Conditioning Engr. Semiann. Meeting, Honolulu, Hawaii, 23 Jun. 1985
(Contracts DE-AC02-76CH-00016; DE-AC05-84OR-21400)
(DE85-014065; CONF-850606-9) Avail: NTIS HC A03/MF A01

This paper addresses the question of the performance of a Ground Coupled Heat Pump (GCHP) system with a water - source heat pump package designed expressly for such systems operating in a northern climate. The project objective is to minimize the life-cycle cost of a GCHP system by optimizing the design of both the heat pump package and the ground coil in concert. In order to achieve this objective, a number of modelling tools are developed or modified to analyze the heat pump's performance and cost and the ground coil's performance. The life-cycle cost of a GCHP system (water-source heat pump with a horizontal ground coil) for an 1800 ft(2) (167 m(2)) house in Pittsburgh, PA, is minimized over a 7 year economic life. Simple payback for the optimized GCHP system, relative to conventional air-source heat pumps, is under 3 years. The water-source heat pump package resulting from this optimization is calculated to cost 21% more than its conventional counterpart with a heating coefficient of performance (COP) about 20% higher, and a cooling COP about 23% higher. In the GCHP system modeled, its annual energy savings are predicted to be about 11% comparred to a system designed around the conventional heat pump while having about the same installation cost. The major conclusion of this study is - GCHP system performance improvement can be attained by improving the water-source heat pump package at less cost than by buying more ground coil. DOE

N86-11485# Sandia Labs., Albuquerque, N. Mex.
NUMERICAL SIMULATION OF A SAMPLE RECOVERY FIXTURE FOR HIGH VELOCITY IMPACT
F. R. Norwood, R. A. Graham, and A. Sawaoka Jun. 1985 5 p refs Presented at the Am. Phys. Soc. Topical Conf. on Shock Waves in Condensed Matter, Spokane, Wash., 22 Jul. 1985 Prepared in cooperation with Tokyo Inst. of Technology, Japan
(Contract DE-AC04-76DP-00789)
(DE85-013965; SAND-85-1511C; CONF-850736-8) Avail: NTIS HC A02/M.F A01

Numerical simulations of shock compression conditions in the sample recovery fixture for high velocity impact were carried out with two dimensional (CSQ) and three dimensional (HULL) computer codes. For the impact of stainless steel on the stainless steel capsule at a velocity of 2.5 km/sec, it is found that two dimensional effects within the low density powder samples dominate the loading process and that interactions between the four samples are nagligible. Because of the much higher pressure encountered, the two dimensional effects are qualitatively different than those found for the Sandia Bear explosive fixtures. It is shown that, in both the axisymmetric and the three dimensional geometry, the radial effects are the dominant feature. These two dimensional radial effects dominate the shock pressures and temperatures such that one dimensional analysis is incorrect and would lead to substantial errors. DOE

N86-11228*# LTV Aerospace and Defense Co., Dallas, Tex. Vought Aero Products Div.
THE FACTORY OF THE FUTURE
J. E. Byman *In* NASA. Langley Research Center Welding, Bonding and Fastening, 1984 Sep. 1985 p 1-9 (For primary document see N86-11227 02-23)
Avail: NTIS HC A21/MF A01 CSCL 13H

N86-11229*# Arc Machines, Inc., Pacoima, Calif.
AUTOMATIC ORBITAL GTAW WELDING: HIGHEST QUALITY WELDS FOR TOMORROW'S HIGH-PERFORMANCE SYSTEMS
Barbara K. Henon *In* NASA. Langley Research Center Welding, Bonding and Fastening, 1984 Sep. 1985 p 11-19 (For primary document see N86-11227 02-32)
Avail: NTIS HC A21/MF A01 CSCL 13H

N86-11232*# SPS Technologies, Jenkintown, Pa.
MECHANICAL FASTENERS FOR ADVANCED COMPOSITE MATERIALS
Richard C. Landt *In* NASA. Langley Research Center Welding, Bonding and Fastening, 1984 Sep. 1985 p 55-65 ref (For primary document see N86-11227 02-23)
Avail: NTIS HC A21/MF A01 CSCL 13E

N86-11233*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THE ALTERNATING SURFACE SEGMENTED LAP JOINT: A DESIGN FOR THIN HIGHLY LOADED JOINTS
Vernon E. Watkins, Jr. and George C. Firth *In its* Welding, Bonding and Fastening, 1984 Sep. 1985 p 67-76 ref (For primary document see N86-11227 02-23)
Avail: NTIS HC A21/MF A01 CSCL 13E

N86-11234*# Martin Marietta Aerospace, New Orleans, La.
AUTOMATIC FASTENING LARGE STRUCTURES: A NEW APPROACH
Donald F. Lumley *In* NASA. Langley Research Center Welding, Bonding and Fastening, 1984 Sep. 1985 p 77-88 (For primary document see N86-11227 02-23)
Avail: NTIS HC A21/MF A01 CSCL 13E

N86-11235*# SPS Technologies, Jenkintown, Pa.
STRESS CORROSION RESISTANT FASTENERS
Thomas A. Roach *In* NASA. Langley Research Center Welding, Bonding and Fastening, 1984 Sep. 1985 p 89-104 (For primary document see N86-11227 02-23)
Avail: NTIS HC A21/MF A01 CSCL 13E

N86-11236*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DERIVATION AND TEST OF ELEVATED TEMPERATURE THERMAL-STRESS-FREE FASTENER CONCEPT
James Wayne Sawyer, Max L. Blosser, and Robert R. McWithey *In its* Welding, Bonding and Fastening, 1984 Sep. 1985 p 105-122 refs (For primary document see N86-11227 02-23)
Avail: NTIS HC A21/MF A01 CSCL 13E

N86-11237*# Battelle Columbus Labs., Ohio.
EXPLOSIVE WELDING IN THE 1990'S
Narain S. Lalwaney and Vonne D. Linse *In* NASA. Langley Research Center Welding, Bonding and Fastening, 1984 Sep. 1985 p 123-140 refs (For primary document see N86-11227 02-23)
Avail: NTIS HC A21/MF A01 CSCL 13H

N86-11238*# Explosive Fabricators, Inc., Louisville, Colo.
EXPLOSIVE WELDING OF TUBULAR CONFIGURATED JOINTS FOR CRITICAL APPLICATIONS
Roy Hardwick *In* NASA. Langley Research Center Welding, Bonding and Fastening, 1984 Sep. 1985 p 141-155 (For primary document see N86-11227 02-23)
Avail: NTIS HC A21/MF A01 CSCL 13H

N86-11239*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EXPLOSIVE TUBE-TO-FITTING JOINING OF SMALL-DIAMETER TUBES
Laurence J. Bement *In its* Welding, Bonding and Fastening, 1984 Sep. 1985 p 157-175 (For primary document see N86-11227 02-23)
Avail: NTIS HC A21/MF A01 CSCL 13H

N86-11240*# Foster Wheeler Corp., Livingston, N.J.
THE USE OF EXPLOSIVE FORMING FOR FASTENING AND JOINING STRUCTURAL AND PRESSURE COMPONENTS
J. Wayne Schroeder *In* NASA. Langley Research Center Welding, Bonding and Fastening, 1984 Sep. 1985 p 177-184 (For primary document see N86-11227 02-23)
Avail: NTIS HC A21/MF A01 CSCL 13H

N86-11241*# Helwan Univ., Cairo (Egypt).
EXPLOSIVE WELDING OF ALUMINUM, TITANIUM AND ZIRCONIUM TO COPPER SHEET METAL
Abdel-Aziz Hegazy and Jim D. Mote (Denver Univ.) *In* NASA. Langley Research Center Welding, Bonding and Fastening, 1984 Sep. 1985 p 185-196 refs (For primary document see N86-11227 02-23)
Avail: NTIS HC A21/MF A01 CSCL 13H

N86-11244*# Northrop Corp., Hawthorne, Calif. Aircraft Div.
SOLID-STATE BONDING OF SUPERPLASTIC ALUMINUM ALLOY 7475 SHEET
Thomas D. S. Byun and Ramsevak B. Vastava *In* NASA. Langley Research Center Welding, Bonding and Fastening, 1984 Sep. 1985 p 231-251 (For primary document see N86-11227 02-23)
Avail: NTIS HC A21/MF A01 CSCL 13H

N86-11245*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EVALUATION OF SUPERPLASTIC FORMING AND WELD-BRAZING FOR FABRICATION OF TITANIUM COMPRESSION PANELS
Dick M. Royster, Thomas T. Bales, and Randall C. Davis *In its* Welding, Bonding and Fastening, 1984 Sep. 1985 p 253-270 refs (For primary document see N86-11227 02-23)
Avail: NTIS HC A21/MF A01 CSCL 13H

N86-11246*# Massachusetts Inst. of Tech., Cambridge.
FEASIBILITY OF REMOTELY MANIPULATED WELDING IN SPACE: A STEP IN THE DEVELOPMENT OF NOVEL JOINING TECHNOLOGIES
Koichi Masubuchi, John E. Agapakis, Andrew DeBiccari, and Christopher vonAlt *In* NASA. Langley Research Center Welding, Bonding and Fastening, 1984 Sep. 1985 p 271-296 refs (For primary document see N86-11227 02-23)
Avail: NTIS HC A21/MF A01 CSCL 13M

N86-11247*# Douglas Aircraft Co., Inc., Long Beach, Calif.
ADVANCES IN JOINING TECHNIQUES USED IN DEVELOPMENT OF SPF/DB TITANIUM SANDWICH REINFORCED WITH METAL MATRICES
J. E. Fischler *In* NASA. Langley Research Center Welding, Bonding and Fastening, 1984 Sep. 1985 p 297-322 (For primary document see N86-11227 02-23)
Avail: NTIS HC A21/MF A01 CSCL 13M

N86-11530# Technion - Israel Inst. of Tech., Haifa. Dept. of Mechanical Engineering.
MECHANICAL FACE SEAL DYNAMICS UPDATE
I. Etison *In* The Shock and Vibration Information Center The Shock and Vibration Digest, Vol. 17, No. 4 Apr. 1985 p 11-15 refs (For primary document see N86-11527 02-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 11/1

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N86-11486 Arizona Univ., Tucson.
RELIABILITY ANALYSIS OF SERIES STRUCTURAL SYSTEMS Ph.D. Thesis
Lidvin Kjerengtroen 1985 175 p
Avail: Univ. Microfilms Order No. DA8511703

Reliability analysis of series structural systems with emphasis on problems typical for metal fatigue is addressed. Answers are sought to the following questions: (1) Given the distribution of strength of the components and the distribution of external loads on the system, what is the probability of failure of the system? (2) Given the target safety index for the system, what would be the target safety index for the components? Exact solutions in the analysis of series structural systems only exists for some special problems. Some of these special problems are investigated. In particular some special cases of the problem of unequal element reliabilities are considered and some interesting observations are made. Numerical integration is in general required even when an exact solution exists. A correction or adjustment factor is developed for an important class of problems. This factor makes it possible to relate element and system probabilities of failure without numerical integration. Dissert. Abstr.

N86-11487# Aeronautical Research Labs., Melbourne (Australia).
NERF: A COMPUTER PROGRAM FOR THE NUMERICAL EVALUATION OF RELIABILITY FUNCTIONS USER MANUAL
A. D. Graham and G. D. Mallinson Feb. 1984 241 p refs
(ARL/STRUC-R-411; AR-003-967) Avail: NTIS HC A11/MF A01

The computer program NERF and its support programs NERPRE and NERPLT provide a versatile facility for the incorporation of statistical variations in the calculation of reliability functions for fatigue failure. The reliability models that can be evaluated by NERF, the use of the NERF suite of programs, the definition of input data, the operating instructions and various results are detailed. Examples, complete with the associated input data and specimen results are also presented. E.A.K.

N86-11488# Army Construction Engineering Research Lab., Champaign, Ill.
UNCERTAINTY ASSESSMENT IN LIFE CYCLE COST ANALYSIS Final Report
May 1985 25 p
(AD-A157414; CERL-SR-P-85/12) Avail: NTIS HC A02/MF A01 CSCL 14/1

Several of the leading probabilistic methods for measuring uncertainties in construction project life cycle costs were studied to evaluate their applicability for military construction projects. The confidence index and statistical testing approaches are discussed in detail; other methods are discussed briefly. The confidence index approach is recommended as a simple, cost-effective method suitable for use in military construction design. GRA

N86-11489# Battelle Pacific Northwest Labs., Richland, Wash.
EXPLORATORY DEVELOPMENT OF FMR (FERROMAGNETIC RESONANCE) ADVANCED SURFACE FLAW DETECTION METHODS Final Report, Aug. 1982 - Aug. 1984
J. M. Prince and B. A. Auld Wright-Patterson AFB, Ohio AFWAL Apr. 1985 78 p
(Contract F33615-82-C-5100)
(AD-A157438; AFWAL-TR-85-4010) Avail: NTIS

HC A05/MF A01 CSCL 14/2

The purpose of this program was to carry forward the development of a microwave eddy current (MEC) probe, which is based on the ferromagnetic resonance (FMR) principle, to the point where its performance in a practical flaw detection breadboard system for gas turbine engine component inspection and its compatibility with the Retirement-for-Cause (RFC) modular inspection system could be demonstrated. This program studied the physical constraints related to the inspection of complex geometries in Ti 6-2-4-6 and IN-100 materials with the MEC-FMR surface flaw detection method. Based on the resulting information, a breadboard inspection system was designed and fabricated to demonstrate the MEC-FMR test method in the inspection of a jet engine interstage seal key slot. GRA

N86-11243*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
LANGLEY RESEARCH CENTER STANDARD FOR THE EVALUATION OF SOCKET WELDS
Robert F. Berry, Jr. *In its* Welding, Bonding and Fastening, 1984 Sep. 1985 p 211-229 (For primary document see N86-11227 02-23)
Avail: NTIS HC A21/MF A01 CSCL 14D

N86-11248*# Texas Instruments, Inc., Attleboro, Mass.
COMPARISON OF BOND IN ROLL-BONDED AND ADHESIVELY BONDED ALUMINUMS
R. J. Schwensfeir, Jr., G. Trenkler, R. G. Delagi, and J. A. Forster *In* NASA. Langley Research Center Welding, Bonding and Fastening, 1984 Sep. 1985 p 323-338 refs (For primary document see N86-11227 02-23)
Avail: NTIS HC A21/MF A01 CSCL 14D

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance.*

N86-11490 California Univ., Berkeley.
ELASTIC WAVE SCATTERING OF A GAUSSIAN INCIDENT BEAM FROM AN INTERFACE CRACK IN A LAYERED HALF SPACE SUBMERGED IN WATER Ph.D. Thesis
Sheryl Marie Gracewski 1984 110 p
Avail: Univ. Microfilms Order No. DA8512837

Many industrial products contain parts with thin coatings or layers bonded to thicker substrates. For quality control of these parts, there is need for a nondestructive evaluation (NDE) method to locate and characterize interface flaws and debonding. In this thesis an analytical model for a typical NDE testing configuration is presented. Time harmonic elastic wave scattering by an interface crack in a liquid-solid layer-solid substrate structure is analyzed. The solution is presented for three incident disturbances. Harmonic normal and shear loadings onto the solid structure are first considered to gain insight into the response characteristics of the structure. The solution for an incident beam of Gaussian profile is then presented since this profile approximates the output of an ultrasonic transducer. The solution of the problem leads to a set of coupled singular integral equations for the jump in displacements across the crack. Dissert. Abstr.

N86-11491 Wisconsin Univ., Madison.
A BODY TENSOR FORMALISM FOR ELASTIC-PLASTIC CONTINUA WITH APPLICATIONS IN UNIAXIAL EXTENSION Ph.D. Thesis
Alan David Freed 1985 173 p
Avail: Univ. Microfilms Order No. DA8507241

The body tensor formalism of Lodge (1974) is extended to include elastic-plastic materials. The fundamental body tensors are defined. The field equations that govern an elastic-plastic continuum are derived from first principles. The covariant strain-rate tensor is postulated to be the sum of two tensors; they are the elastic and plastic, covariant, strain-rate tensors. The elastic and plastic, covariant, strain tensors are obtained by integration. Their sum equals the covariant strain tensor, regardless of the magnitude of the deformation. The thermoelastic relationships for stress and entropy are derived from first principles. The elastic potential must be continuous and twice-differentiable in the thermostatic state variable for these equations to be consistent with Caratheodory's (1909) theory of thermostatics. The classical theory of elasticity is obtained as a special case. Components of the fundamental tensors are determined for the process of uniform extension. Dissert. Abstr.

N86-11492 Tennessee Univ., Knoxville.
THE STABILITY OF TIMOSHENKO BEAMS CONVEYING A COMPRESSIBLE FLUID Ph.D. Thesis
Robert Ost Johnson 1984 175 p
Avail: Univ. Microfilms Order No. DA8506899

The purpose is to formulate and solve the stability problem associated with the equations of motion of a Timoshenko beam conveying a compressible fluid. The beam is assumed to be either cantilevered or simply supported. Shear deformation and rotary inertia are considered in the Timoshenko beam theory. The beam analysis that is carried out is quite general and allows for viscous damping external to the tube as well as both internal strain rate and hysteretic damping. Interactions between these three damping mechanisms, shear deformation, and rotary inertia also are accounted for. The compressible, isenitropic flow through the tube is governed by Euler's equations of motion. Gravitational effects are neglected in the analysis. This is equivalent to assuming that the tube is horizontal. The motion of the fluid is coupled to that of the beam by a compatibility condition at the tube wall which requires that they vibrate together. Dissert. Abstr.

N86-11493 Polytechnic Inst. of New York, Brooklyn.
BOUNDED STATE CONTROL OF LINEAR SYSTEMS WITH APPLICATION TO THE ACTIVE STRUCTURAL CONTROL Ph.D. Thesis
Sang-Kook Lee 1985 126 p
Avail: Univ. Microfilms Order No. DA8506858

A new approach to be used in active control of structures was attempted. The motivation for this research came from consideration of controlling a civil engineering structure exposed to environmental loads, such as wind gusts, earthquakes, etc. Often, the main purpose of structural control is to keep all the controlled variables, e.g., displacements and velocities, inside an allowable region which may be determined by the needs of structural safety and human comfort. The specification of structural safety and comfort of the occupants was directly formulated with a topology in state space, but not with a certain cost function to be minimized with respect to the control law. A sufficient and necessary condition on the existence of linear state feedback control law which guarantees the specified performance, i.e., bounded region, was established. The control law obtained guarantees that the motion of a structure remain within an allowable region under an assumed class of disturbances. Dissert. Abstr.

N86-11494 Purdue Univ., Lafayette, Ind.
EFFECT OF A VISCOELASTIC BOUNDARY INSET ON VIBRATIONAL CHARACTERISTICS OF A BEAM Ph.D. Thesis
Mehdi Ilkhani-Pour 1984 144 p
Avail: Univ. Microfilms Order No. DA8507695

The effect of a viscoelastic (elastomeric) inset on the vibrational characteristics of a cantilevered beam in flexural motion is examined. The inset is placed at the support fixture of the beam. A closed form solution is obtained for the cyclic energy dissipation due to the inset. The validity of analytical results are confirmed by a good comparison with available test data in the literature. Expressions are then developed for the effect of the inset on fundamental natural frequency and damping ratio of the beam. The former is achieved by modifying the boundary conditions of a cantilevered beam, so as to allow for support rotation and

displacement due to elasticity of the inset. The results of a series of experiments, concerning the fundamental natural frequency and damping ratio of two steel beams with a soft polymeric inset, are reported. Again, good agreement is observed between theory and experiments. The existence of an optimum inset length, resulting in maximum energy dissipation, was revealed by both theory and experiments. A further increase in the inset length beyond this value causes a reduction in energy dissipation. Dissert. Abstr.

N86-11495*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TURBINE ENGINE HOT SECTION TECHNOLOGY (HOST)
Oct. 1983 250 p refs Workshop held in Cleveland, Ohio, 25-26 Oct. 1983
(NASA-CP-2289; E-1816; NAS 1.55:2289) Avail: NTIS HC A11/MF A01 CSCL 21E

A two-day workshop on the research and plans for turbine engine hot section durability problems was held on October 25 and 26, 1983, at the NASA Lewis Research Center. Presentations were made during six sessions, including structural analysis, fatigue and fracture, surface protective coatings, combustion, turbine heat transfer, and instrumentation, that dealt with the thermal and fluid environment around liners, blades, and vanes, and with material coatings, constitutive behavior, stress-strain response, and life prediction methods for the three components. The principal objective of each session was to disseminate the research results to date, along with future plans, in each of the six areas. Contract and government researchers presented results of their work. For individual titles, see N86-11496 through N86-11521.

N86-11496*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TURBINE ENGINE HOT SECTION TECHNOLOGY (HOST) PROJECT
Daniel E. Sokolowski and C. Robert Ensign *In its* Turbine Eng. Hot Sect. Technol. (HOST) Oct. 1983 p 1-6 (For primary document see N86-11495 02-39)
Avail: NTIS HC A11/MF A01 CSCL 21E

The Hot Section Technology (HOST) Project is a NASA-sponsored endeavor to improve the durability of advanced gas turbine engines for commercial and military aircraft. Through improvements in the analytical models and life prediction systems, designs for future hot section components , the combustor and turbine, will be more accurately analyzed and will incorporate features required for longer life in the more hostile operating environment of high performance engines. G.L.C.

N86-11497*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HOST INSTRUMENTATION R AND D PROGRAM OVERVIEW **c35**
D. R. Englund *In its* Turbine Eng. Hot Sect. Technol. (HOST) Oct. 1983 p 7-9 (For primary document see N86-11495 02-39)
Avail: NTIS HC A11/MF A01 CSCL 14B

The HOST Instrumentation R&D program is focused on two categories of instrumentation. One category is that required to characterize the environment imposed on the hot section components of turbine engines. This category includes instruments for measuring gas flow, gas temperature, and heat flux. The second category is that for measuring the effect of the environment on the hot section components. This category includes strain measuring instruments and an optical system for viewing the interior of an operating combustor to detect cracks, buckling, carbon buildup, etc. G.L.C.

N86-11498*# United Technologies Research Center, East Hartford, Conn.
HOT SECTION VIEWING SYSTEM **c35**
William W. Morey *In* NASA. Lewis Research Center Turbine Eng. Hot Sect. Technol. (HOST) Oct. 1983 p 11-16 (For primary document see N86-11495 02-39)
Avail: NTIS HC A11/MF A01 CSCL 14B

The objective of the hot section viewing program is to develop a prototype optical system for viewing the interior of a gas turbine combustor during high temperature, high pressure operation in order to produce a visual record of some causes of premature hot section failures. The program began by identifying and analyzing system designs that would provide clearest images while being able to survive the hostile environment inside the combustion chamber. Different illumination methods and computer techniques for image enhancement and analysis were examined during a preliminary test phase. In the final phase of the program the prototype system was designed and fabricated and is currently being tested on a high pressure combustor rig. G.L.C.

N86-11499*# Pratt and Whitney Aircraft, East Hartford, Conn. Engineering Div.
DYNAMIC GAS TEMPERATURE MEASUREMENT SYSTEM **c35**
Denny L. Elmore, Woodrow W. Robinson, and William B. Watkins *In* NASA. Lewis Research Center Turbine Eng. Hot Sect. Technol. (HOST) Oct. 1983 p 17-35 ref (For primary document see N86-11495 02-39)
(Contract NAS3-23154)
Avail: NTIS HC A11/MF A01 CSCL 14B

A gas temperature measurement system with compensated frequency response of 1 KHz and capability to operate in the exhaust of a gas turbine combustor was developed. Environmental guidelines for this measurement are presented, followed by a preliminary design of the selected measurement method. Transient thermal conduction effects were identified as important; a preliminary finite-element conduction model quantified the errors expected by neglecting conduction. A compensation method was developed to account for effects of conduction and convection. This method was verified in analog electrical simulations, and used to compensate dynamic temperature data from a laboratory combustor and a gas turbine engine. Detailed data compensations are presented. Analysis of error sources in the method were done to derive confidence levels for the compensated data. G.L.C.

N86-11500*# United Technologies Research Center, East Hartford, Conn.
HIGH TEMPERATURE STATIC STRAIN SENSOR DEVELOPMENT PROGRAM **c35**
Charles Hulse, Richard Bailey, and Howard Grant (Pratt and Whitney Aircraft Group, East Hartford, Conn.) *In* NASA. Lewis Research Center Turbine Eng. Hot Sect. Technol. (HOST) Oct. 1983 p 37-40 (For primary document see N86-11495 02-39)
(Contract NAS3-23722)
Avail: NTIS HC A11/MF A01 CSCL 14B

Electrical resistance strain gages useful for static strain measurements on nickel or cobalt superalloy parts inside a gas turbine engine on a test stand are being developed. Measurements of this type are of great importance in meeting the goals of the HOST program because, without reliable knowledge of the stresses and strains which exist in specific components, it will be difficult to fully appreciate where improvements in design and materials can be implemented. The first part of the effort consisted of a strain gage alloy development program which will be followed by an investigation of complete strain gage systems which will use the best of the alloys developed together with other system improvements. G.L.C.

N86-11501*# United Technologies Research Center, East Hartford, Conn.
DEMONSTRATION TEST OF BURNER LINER STRAIN MEASUREMENT SYSTEMS: INTERIM RESULTS
Karl A. Stetson and Howard P. Grant (Pratt and Whitney Aircraft, East Hartford, Conn.) *In* NASA. Lewis Research Center Turbine Eng. Hot Sect. Technol. (HOST) Oct. 1983 p 41-44 (For primary document see N86-11495 02-39)
(Contract NAS3-23690)
Avail: NTIS HC A11/MF A01 CSCL 20K

Work is in progress to demonstrate two techniques for static strain measurements on a jet engine burner liner. Measurements are being made with a set of resistance strain gages made from Kanthal A-1 wire and via heterodyne speckle photogrammetry.

The background of the program is presented along with current results. Author

N86-11502*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Engineering Div.
DEVELOPMENT OF HEAT FLUX SENSORS FOR TURBINE AIRFOILS AND COMBUSTOR LINERS **c35**
William H. Atkinson *In* NASA. Lewis Research Center Turbine Eng. Hot Sect. Technol. (HOST) Oct. 1983 p 45-55 ref (For primary document see N86-11495 02-39)
Avail: NTIS HC A11/MF A01 CSCL 14B

The design of durable turbine airfoils that use a minimum amount of cooling air requires knowledge of the heat loads on the airfoils during engine operation. Measurement of these heat loads will permit the verification or modification of the analytical models used in the design process and will improve the ability to predict and confirm the thermal performance of turbine airfoil designs. Heat flux sensors for turbine blades and vanes must be compatible with the cast nickel-base and cobalt-base materials used in their fabrication and will need to operate in a hostile environment with regard to temperature, pressure and thermal cycling. There is also a need to miniaturize the sensors to obtain measurements without perturbing the heat flows that are to be measured. G.L.C.

N86-11503*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LASER ANEMOMETRY FOR HOT SECTION APPLICATIONS **c36**
Richard G. Seasholtz, Lawrence G. Oberle, and Donald H. Weikle *In its* Turbine Eng. Hot Sect. Technol (HOST) Oct. 1983 p 57-67 refs (For primary document see N86-11495 02-39)
Avail: NTIS HC A11/MF A01 CSCL 20E

Laser anemometers (LA's) for use in the study of the hot section components of turbomachinery are being developed. Specifically, laser anemometers are being developed for use in the 50.8-cm (20-in.) diameter warm turbine and high-pressure turbine (HPT) facilities at Lewis. A brief review of the status of the program along with some preliminary data taken in an open-jet burner are presented. G.L.C.

N86-11504*# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Chemical Engineering.
TIME-OF-FLIGHT ANEMOMETER FOR HOT SECTION APPLICATIONS **c35**
Robert V. Edwards *In* NASA. Lewis Research Center Turbine Eng. Hot Sect. Technol. (HOST) Oct. 1983 p 69-71 (For primary document see N86-11495 02-39)
Avail: NTIS HC A11/MF A01 CSCL 14B

The design, construction and testing of laser anemometer configurations for Hot Section velocity measurements is considered. Optimizing the laser anemometer system necessarily included the data processing algorithms used. It is felt that the requirements here are too demanding for standard laser anemometer systems. G.L.C.

N86-11505*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TURBINE HEAT TRANSFER **c34**
John E. Rohde *In its* Turbine Eng. Hot Sect. Technol. (HOST) Oct. 1983 p 73-77 (For primary document see N86-11495 02-39)
Avail: NTIS HC A11/MF A01 CSCL 20D

Improved turbine durability and performance and reduced development cost will all result from impoved methods of predicting turbine metal temperatures. Better metal temperature prediction methods require improvements in the methods of predicting the hot gas flow over the turbine airfoils and the cooling air flow inside the airfoil and in the methods of predicting the heat transfer rates on both the hot gas side and coolant side of the airfoil. The overall HOST Turbine Heat Transfer effort is directed at improving all four of these areas of concern. G.L.C.

N86-11506*# Tennessee Univ. Space Inst., Tullahoma.
GAS FLOW ENVIRONMENTAL AND HEAT TRANSFER NON-ROTATING 3D PROGRAM **c34**
T. Geil and J. Steinhoff *In* NASA. Lewis Research Center Turbine Eng. Hot Sect. Technol. (HOST) Oct. 1983 p 79-86 (For primary document see N86-11495 02-39)
(Contract NAS3-23278)
Avail: NTIS HC A11/MF A01 CSCL 20D

A complete set of benchmark quality data for the flow and heat transfer within a large rectangular turning duct is being compiled. These data will be used to evaluate and verify three dimensional internal viscous flow models and computational codes. The analytical objective is to select such a computational code and define the capabilities of this code to predict the experimental results. Details of the proper code operation will be defined and improvements to the code modeling capabilities will be formulated. G.L.C.

N86-11507*# Detroit Diesel Allison, Mich.
GAS SIDE HEAT TRANSFER **c34**
Larry D. Hylton *In* NASA. Lewis Research Center Turbine Eng. Hot Sect. Technol. (HOST) Oct. 1983 p 87-99 refs (For primary document see N86-11495 02-39)
(Contracts NAS3-22761; NAS3-23695)
Avail: NTIS HC A11/MF A01 CSCL 20D

Improvements in methods for predicting heat transfer rates on the hot gas side of turbine airfoils are necessary for improved turbine durability and performance. The development and verification of improved analytical models requires a systematic, closely coupled experimental and analytical program. G.L.C.

N86-11508*# United Technologies Research Center, East Hartford, Conn.
ASSESSMENT OF A 3-D BOUNDARY LAYER CODE TO PREDICT HEAT TRANSFER AND FLOW LOSSES IN A TURBINE **c34**
Veer N. Vatsa *In* NASA. Lewis Research Center Turbine Eng. Hot Sect. Technol. (HOST) Oct. 1983 p 101-106 refs (For primary document see N86-11495 02-39)
(Contract NAS3-23716)
Avail: NTIS HC A11/MF A01 CSCL 20D

The prediction of the complete flow field in a turbine passage is an extremely difficult task due to the complex three dimensional pattern which contains separation and attachment lines, a saddle point and horseshoe vortex. Whereas, in principle such a problem can be solved using full Navier-Stokes equations, in reality methods based on a Navier-Stokes solution procedure encounter difficulty in accurately predicting surface quantities (e.g., heat transfer) due to grid limitations imposed by the speed and size of the existing computers. On the other hand the overall problem is strongly three dimensional and too complex to be analyzed by the current design methods based on inviscid and/or viscous strip theories. Thus there is a strong need for enhancing the current prediction techniques through inclusion of 3-D viscous effects. A potentially simple and cost effective way to achieve this is to use a prediction method based on three dimensional boundary layer (3-DBL) theory. The major objective of this program is to assess the applicability of such a 3-DBL approach for the prediction of heat loads, boundary layer growth, pressure losses and streamline skewing in critical areas of a turbine passage. A brief discussion of the physical problem addressed here along with the overall approach is presented. Author

N86-11509*# United Technologies Research Center, East Hartford, Conn.
GAS-SIDE HEAT TRANSFER WITH ROTATION **c34**
Robert P. Dring *In* NASA. Lewis Research Center Turbine Eng. Hot Sect. Technol. (HOST) Oct. 1983 p 107-109 refs (For primary document see N86-11495 02-39)
Avail: NTIS HC A11/MF A01 CSCL 20D

The primary basis for heat transfer analysis of turbine blades is experimental data obtained in linear cascades. These data have been very valuable in identifying the major heat transfer and fluid

flow features of a turbine airfoil. The question of major interest is how well all of these data translate to the rotating turbine blade. It is known from the work of Lokay and Trushin that average heat transfer coefficients on the rotor may be as much as 40 percent above the values measured on the same blades nonrotating. Recent work by Dunn and Holt supports the Russian conclusion. What is lacking is a set of data from a rotating system which is of sufficient detail as to make careful local comparisons between static system in which there is sufficient documentation of the flow field to support the computer analyses being developed today. A second major question is the influence, if any, of the first stator row on the heat transfer of the second stator row after the flow has passed through the rotor. An objective of the present program, is to obtain a detailed set of heat transfer coefficients along the midspan of a blade in a rotating turbine. Author

N86-11510*# Pratt and Whitney Aircraft Group, East Hartford, Conn.

COOLANT PASSAGE HEAT TRANSFER WITH ROTATION. A PROGRESS REPORT ON THE COMPUTATIONAL ASPECTS **c34**

L. D. Aceto and G. J. Sturgess *In* NASA. Lewis Research Center Turbine Eng. Hot Sect. Technol. (HOST) Oct. 1983 p 111-116 refs (For primary document see N86-11495 02-39)
Avail: NTIS HC A11/MF A01 CSCL 20D

Turbine airfoils are subjected to increasingly higher heat loads which escalate the cooling requirements in order to satisfy life goals for the component materials. If turbine efficiency is to be maintained, however, cooling requirements should be as low as possible. To keep the quantity of cooling air bounded, a more efficient internal cooling scheme must be developed. One approach is to employ airfoils with multipass cooling passages that contain devices to augment internal heat transfer while limiting pressure drop. Design experience with multipass cooling passage airfoils has shown that a surplus of cooling air must be provided as a margin of safety. This increased cooling air leads to a performance penalty. Reliable methods for predicting the internal thermal and aerodynamic performance of multipass cooling passage airfoils would reduce or eliminate the need for the safety margin of surplus cooling air. The objective of the program is to develop and verify improved analytical methods that will form the basis for design technology which will result in efficient turbine components with improved durability without sacrificing performance. The objective will be met by: (1) establishing a comprehensive experimental data base that can form the basis of an empirical design system; (2) developing computational fluid dynamic techniques; and (3) analyzing the information in the data base with both phenomenological modeling and mathematical modeling to derive a suitable design and analysis procedure. Author

N86-11511*# Arizona State Univ., Tempe. Dept. of Mechanical and Aerospace Engineering.

JET ARRAY IMPINGEMENT HEAT TRANSFER CHARACTERISTICS **c34**

L. W. Florschuetz and D. E. Metzger *In* NASA. Lewis Research Center Turbine Eng. Hot Sect. Technol. (HOST) Oct. 1983 p 117-128 refs (For primary document see N86-11495 02-39)
Avail: NTIS HC A11/MF A01 CSCL 20D

Two dimensional arrays of circular air jets impinging on a heat transfer surface parallel to the jet orifice plate are considered. The jet flow, after impingement, is constrained to exit in a single direction along the channel formed by the jet orifice plate and the heat transfer surface. In addition to the crossflow which originates from the jets following impingement, an initial crossflow is present which approaches the array through an upstream extension of the channel. The configurations considered are intended to model the impingement cooled midchord region of gas turbine airfoils in cases where an initial crossflow is also present. A major objective is determination of the effect of initial crossflow air temperature relative to jet array air temperature on impingement surface heat fluxes. Author

N86-11512*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

COMBUSTION HOT SECTION TECHNOLOGY **c07**

David B. Ercegovic *In its* Turbine Eng. Hot Sect. Technol. (HOST) Oct. 1983 p 129-133 refs (For primary document see N86-11495 02-39)
Avail: NTIS HC A11/MF A01 CSCL 21E

The overall objective of the Turbine Engine Hot Section Technology Combustion Project is to develop and verify improved and more accurate analysis methods for increasing the ability to design with confidence the combustion system for advanced aircraft turbine engines. The analysis methods developed will be generically applicable to combustion systems and not restricted to one specific engine or manufacturer. This project's approach was to first assess and evaluate existing combustor aerothermal analysis models by means of a contracted effort initiated during FY 1982. This evaluation effort has assessed and quantified known models' strengths and deficiencies. During FY 1984 the Aerothermal Modeling Program, Phase 2 will be initiated, which is expected to have contracted model development efforts in the areas of improved numerical methods for turbulent viscous flows, flow interactions, and fuel spray flow foekd interactions. A Phase 3 effort is planned to address remaining model deficiencies. The primary inhouse effort in this area will be the determination of high pressure flame radiation characteristics in a full annular combustor. This experiment will be conducted in the NASA LeRC High Pressure Facility with the results compiled into a comprehensive flame radiation and liner heat flux model. Author

N86-11513*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

HOST STRUCTURAL ANALYSIS PROGRAM OVERVIEW **c07**

R. H. Johns *In its* Turbine Eng. Hot Sect. Technol. (HOST) Oct. 1983 p 153-158 (For primary document see N86-11495 02-39)
Avail: NTIS HC A11/MF A01 CSCL 21E

Hot section components of aircraft gas turbine engines are subjected to severe thermal structural loading conditions, especially during the start up and take off portions of the engine cycle. The most severe and damaging stresses and strains are those induced by the steep thermal gradients induced during the start up transient. These transient stresses and strains are also the most difficult to predict, in part because of the temperature gradients and distributions are not well known or readily predictable, and also because the cyclic elastic viscoplastic behavior of the materials at these extremes of temperature and strain are not well known or readily predictable. A broad spectrum of structures related technology programs is underway to address these deficiencies. One element of the structures program is developing improved time varying thermal mechanical load models for the entire engine mission cycle from start up to shutdown. Another major part of the program is the development of new and improved nonlinear 3-D finite elements and associated structural analysis programs, including the development of temporal elements with time dependent properties to account for creep effects in the materials and components. Author

N86-11514*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Business Group.

BURNER LINER THERMAL/STRUCTURAL LOAD MODELLING

R. J. Maffeo *In* NASA. Lewis Research Center Turbine Eng. Hot Sect. Technol. (HOST) Oct. 1983 p 159-163 (For primary document see N86-11495 02-39)
(Contract NAS3-23272)
Avail: NTIS HC A11/MF A01 CSCL 20K

The objective of this program is to develop a thermal data transfer computer program module for the burner liner thermal structural load modeling program. This will be accomplished by (1) reviewing existing methodologies for thermal data transfer and selecting three heat transfer codes for application in this program; (2) evaluating the selected codes to establish criteria for developing a computer program module to transfer thermal data from the heat transfer codes to selected stress analysis codes; (3) developing the automated thermal load transfer module; and

(4) verifying and documenting the module. In aircraft turbine engine hot section components, cyclic thermal stresses are the most important damage mechanism. Consequently, accurate and reliable prediction of thermal loads is essential to improving durability. To achieve this goal, a considerable effort over the past 20 years has been devoted to the acquisition of engine temperature test data, as well as the development of accurate, reliable, and efficient computer codes for the prediction of steady state and transient temperatures and for the calculation of elastic and inelastic cyclic stresses and strains in hot section components. There is a need for continued development of these codes, because the availability of more accurate analysis techniques for complex configurations has enabled engine designers to use more sophisticated designs to achieve higher cycle efficiency and reduce weight. Author

N86-11515*# General Electric Co., Cincinnati, Ohio.
COMPONENT-SPECIFIC MODELING **c07**
M. L. Roberts *In* NASA. Lewis Research Center Turbine Eng. Hot Sect. Technol. (HOST) Oct. 1983 p 165-173 (For primary document see N86-11495 02-39)
(Contract NAS3-23687)
Avail: NTIS HC A11/MF A01 CSCL 21E

The overall objective of this program is to develop and verify a series of interdisciplinary modeling and analysis techniques which have been specialized to address three specific hot section components. These techniques will incorporate data as well as theoretical methods from many diverse areas, including cycle and performance analysis, heat transfer analysis, linear and nonlinear stress analysis, and mission analysis. Building on the proven techniques already available in these fields, the new methods developed through this contract will be integrated to provide an accurate, efficient, and unified approach to analyzing combustor burner liners, hollow air cooled turbine blades, and air cooled turbine vanes. For these components, the methods developed will predict temperature, deformation, stress, and strain histories throughout a complete flight mission. Author

N86-11516*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Business Group.
THE 3D INELASTIC ANALYSIS METHODS FOR HOT SECTION COMPONENTS
L. T. Dame and R. L. McKnight *In* NASA. Lewis Research Center Turbine Eng. Hot Sect. Technol. (HOST) Oct. 1983 p 175-177 refs (For primary document see N86-11495 02-39)
Avail: NTIS HC A11/MF A01 CSCL 20K

The objective of this research is to develop an analytical tool capable of economically evaluating the cyclic time dependent plasticity which occurs in hot section engine components in areas of strain concentration resulting from the combination of both mechanical and thermal stresses. The techniques developed must be capable of accommodating large excursions in temperatures with the associated variations in material properties including plasticity and creep. The overall objective of this proposed program is to develop advanced 3-D inelastic structural/stress analysis methods and solution strategies for more accurate and yet more cost effective analysis of combustors, turbine blades, and vanes. The approach will be to develop four different theories, one linear and three higher order with increasing complexities including embedded singularities. Author

N86-11517*# Pratt and Whitney Aircraft, East Hartford, Conn.
THE 3-D INELASTIC ANALYSIS METHODS FOR HOT SECTION COMPONENTS (BASE PROGRAM)
E. S. Todd *In* NASA. Lewis Research Center Turbine Eng. Hot Sect. Technol. (HOST) Oct. 1983 p 179-180 (For primary document see N86-11495 02-39)
Avail: NTIS HC A11/MF A01 CSCL 20K

The objective of this program is to produce a series of new computer codes that permit more accurate and efficient three dimensional inelastic analysis of selected hot section components - combustor liners, turbine blades and turbine vanes. The computer codes embody a progression of mathematical models and are streamlined to take advantage of geometrical features, loading conditions, and forms of material response that distinguish each group of selected components. Author

N86-11518*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
VALIDATION OF STRUCTURAL ANALYSIS METHODS USING BURNER LINER CYCLIC RIG TEST DATA
R. Thompson *In its* Turbine Eng. Hot Sect. Technol. (HOST) Oct. 1983 p 181-193 (For primary document see N86-11495 02-39)
Avail: NTIS HC A11/MF A01 CSCL 20K

The objectives of the hot section technology (HOST) burner liner cyclic rig test program are basically threefold: (1) to assist in developing predictive tools needed to improve design analyses and procedures for the efficient and accurate prediction of burner liner structural response; (2) to calibrate, evaluate and validate these predictive tools by comparing the predicted results with the experimental data generated in the tests; and (3) to evaluate existing as well as advanced temperature and strain measurement instrumentation, both contact and noncontact, in a simulated engine cycle environment. The data generated will include measurements of the thermal environment (metal surface temperatures) as well as structural (strain) and life (fatigue) responses of simulated burner liners and specimens under controlled boundary and operating conditions. These data will be used to calibrate, compare and validate analytical theories, methodologies and design procedures, as well as improvements in them, for predicting liner temperatures, stress-strain responses and cycles to failure. Comparison of predicted results with experimental data will be used to show where the predictive theories, etc. need improvements. In addition, as the predictive tools, as well as the tests, test methods, and data acquisition and reduction techniques, are developed and validated, a proven, integrated analysis/experiment method will be developed to determine the cyclic life of a simulated burner liner. Author

N86-11519*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HOST LINER CYCLIC FACILITIES
Donald Schultz *In its* Turbine Eng. Hot Sect. Technol. (HOST) Oct. 1983 p 195-204 (For primary document see N86-11495 02-39)
Avail: NTIS HC A11/MF A01 CSCL 20K

The HOST Liner Cyclic Program is utilizing two types of test apparatus, rectangular box rigs and a full annular rig. To date two quartz lamp cyclic box rigs have been tested and a third is to begin testing in late October 1983. The box rigs are used to evaluate 5x8 inch rectangular linear samples. A 21 inch diameter outer liner simulator is also being built up for testing beginning in April 1984. All rigs are atmospheric rigs. The first box rig, a three 6-kVA lamp installation, was operated under adverse conditions to determine feasibility of using quartz lamps for cyclic testing. This work was done in December 1981 and looked promising. The second box rig, again using three 6-kVA lamps, was operated to obtain instrumentation durability information and initial data input to a Finite Element Model. This limited test program was conducted in August 1983. Five test plates were run. Instrumentation consisted of strain gages, thermocouples and thermal paint. The strain gages were found to fail at 1200 F as expected though plates were heated to 1700 F. The third box rig, containing four 6-kVA lamps, is in build up for testing to begin in late October 1983. In addition to 33 percent greater power input, this rig has provision for 400 F backside line cooling air and a viewing port suitable for IR camera viewing. The casing is also water cooled for extended durability. Author

N86-11520*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LIFE PREDICTION AND CONSTITUTIVE BEHAVIOR
G. R. Halford *In its* Turbine Eng. Hot Sect. Technol. (HOST) Oct. 1983 p 205-207 (For primary document see N86-11495 02-39)
Avail: NTIS HC A11/MF A01 CSCL 20K

One of the primary drivers that prompted the initiation of the hot section technology (HOST) program was the recognized need for improved cyclic durability of costly hot section components. All too frequently, fatigue in one form or another was directly responsible for the less than desired durability, and prospects for the future weren't going to improve unless a significant effort was mounted to increase our knowledge and understanding of the elements governing cyclic crack initiation and propagation lifetime. Certainly one of the important factors is the ability to perform accurate structural stress-strain analyses on a routine basis to determine the magnitudes of the localized stresses and strains since it is these localized conditions that govern the initiation and crack growth processes. Developing the ability to more accurately predict crack initiation lifetimes and cyclic crack growth rates for the complex loading conditions found in turbine engine hot sections is of course the ultimate goal of the life prediction research efforts. It has been found convenient to divide the research efforts into those dealing with nominally isotropic and anisotropic alloys; the latter for application to directionally solidified and single crystal turbine blades. Author

N86-11521*# Pratt and Whitney Aircraft, East Hartford, Conn.
CREEP FATIGUE LIFE PREDICTION FOR ENGINE HOT SECTION MATERIALS (ISOTROPIC)
Vito Moreno *In* NASA. Lewis Research Center Turbine Eng. Hot Sect. Technol. (HOST) Oct. 1983 p 209-210 (For primary document see N86-11495 02-39)
(Contract NAS3-23288)
Avail: NTIS HC A11/MF A01 CSCL 20K

The activities performed during the first year of the NASA HOST Program, Creep Fatigue Life Prediction for Engine Hot Section Materials (Isotropic), being conducted by Pratt & Whitney Aircraft are summarized. The program is a 5 year, two part effort aimed at improving the high temperature crack initiation prediction technology for gas turbine hot section components. Significant results of the program produced thus far are discussed. Cast B1900 + Hf and wrought IN 718 were selected as the base and alternate materials, respectively. A single heat of B1900 + Hf was obtained and test specimens fabricated. The material was characterized with respect to grain size, gamma prime size, carbide distribution, and dislocation density. Monotonic tensile and creep testing has shown engineering properties within anticipated scatter for this material. Examination of the tensile tests has shown a transition from inhomogeneous planar slip within the grains at lower temperatures to more homogeneous matrix deformation. Examination of the creep tests has shown a transgranular failure mode at 1400 F and an intergranular failure mode at 1600 F and 1800 F. Author

N86-11522*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A STUDY OF THE CORNERING FORCES GENERATED BY AIRCRAFT TIRES ON A TILTED, FREE-SWIVELING NOSE GEAR
Robert H. Daugherty and Sandy M. Stubbs Oct. 1985 30 p refs (NASA-TP-2481; L-15954; NAS 1.60:2481) Avail: NTIS HC A03/MF A01 CSCL 20K

An experimental investigation was conducted to study the effect of various parameters on the cornering forces produced by a rolling aircraft tire installed on a tilted, free-swiveling nose gear. The parameters studied included tilt angle, trial, tire inflation pressure, rake angle, vertical load, and whether or not a twin tire configuration corotates. These parameters were evaluated by measuring the cornering force produced by an aircraft tire installed on the nose gear of a modified vehicle as it was towed slowly. Cornering force coefficient increased with increasing tilt angle. Increasing trial or rake angle decreased the magnitude of the cornering force coefficient. Tire inflation pressure had no effect on the cornering force coefficient. Increasing vertical load decreased the cornering force coefficient. When the tires of a twin tire system rotated independently, the cornering force coefficients were the same as those for the single-tire configuration. When the twin tire system was made to corotate, however, the cornering force coefficients increased significantly. Author

N86-11523*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AEROELASTIC MODEL HELICOPTER ROTOR TESTING IN THE LANGLEY TDT
Wayne R. Mantay, William T. Yeager, Jr., M-Nabil Hamouda, Robert G. Cramer, Jr., and Chester W. Langston Jun. 1985 19 p refs Presented at AHS Specialists' Meeting on Helicopter Test Methodology, 29 Oct. - 1 Nov. 1984, Williamsburg, Va.
(DA Proj. 1L1-62209-AH-76)
(NASA-TM-86440; NAS 1.15:86440; USAAVSCOM-TM-85-B-5) Avail: NTIS HC A02/MF A01 CSCL 20K

Wind-tunnel testing of a properly scaled aeroelastic model helicopter rotor is considered a necessary phase in the design development of new or existing rotor systems. For this reason, extensive testing of aeroelastically scaled model rotors is done in the Transonic Dynamics Tunnel (TDT) located at the NASA Langley Research Center. A unique capability of this facility, which enables proper dynamic scaling, is the use of Freon as a test medium. A description of the TDT and a discussion of the benefits of using Freon as a test medium are presented. A description of the model test bed used, the Aeroelastic Rotor Experimental System (ARES), is also provided and examples of recent rotor tests are cited to illustrate the advantages and capabilities of aeroelastic model rotor testing in the TDT. The importance of proper dynamic scaling in identifying and solving rotorcraft aeroelastic problems, and the importance of aeroelastic testing of model rotor systems in the design of advanced rotor systems are demonstrated. Author

N86-11524*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
STRESS ANALYSES OF B-52 PYLON HOOKS
William L. Ko and Lawrence S. Schuster Oct. 1985 33 p refs (NASA-TM-84924; H-1221; NAS 1.15:84924) Avail: NTIS HC A03/MF A01 CSCL 20K

The NASTRAN finite element computer program was used in the two dimensional stress analysis of B-52 carrier aircraft pylon hooks: (1) old rear hook (which failed), (2) new rear hook (improved geometry), (3) new DAST rear hook (derated geometry), and (4) front hook. NASTRAN model meshes were generated by the aid of PATRAN-G computer program. Brittle limit loads for all the four hooks were established. The critical stress level calculated from NASTRAN agrees reasonably well with the values predicted from the fracture mechanics for the failed old rear hook. Author

N86-11525*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A COMPARISON OF MEASURED AND CALCULATED THERMAL STRESSES IN A HYBRID METAL MATRIX COMPOSITE SPAR CAP ELEMENT
Jerald M. Jenkins, Allan H. Taylor (NASA, Langley Research Center), and I. Frank Sakata (Lockheed California Co., Burbank) Sep. 1985 20 p refs
(NASA-TM-86729; H-1289; NAS 1.15:86729) Avail: NTIS HC A02/MF A01 CSCL 20K

A hybrid spar of titanium with an integrally brazed composite, consisting of an aluminum matrix reinforced with boron-carbide-coated fibers, was heated in an oven and the resulting thermal stresses were measured. Uniform heating of the spar in an oven resulted in thermal stresses arising from the effects of dissimilar materials and anisotropy of the metal matrix composite. Thermal stresses were calculated from a finite element structural model using anisotropic material properties deduced from constituent properties and rules of mixtures. Comparisons of calculated thermal stresses with measured thermal stresses on the spar are presented. It was shown that failure to account for anistropy in the metal matrix composite elements would result in large errors in correlating measured and calculated thermal stresses. It was concluded that very strong material characterization efforts are required to predict accurate thermal stresses in anisotropic composite structures. Author

N86-11526*# Connecticut Univ., Storrs. School of Engineering.
ELEVATED TEMPERATURE BIAXIAL FATIGUE Final Report
Eric H. Jordan Oct. 1985 162 p refs
(Contract NAS3-160)
(NASA-CR-175009; NAS 1.26:175009) Avail: NTIS HC A08/MF A01 CSCL 20K

A 3 year experimental program for studying elevated temperature biaxial fatigue of a nickel based alloy Hastelloy-X has been completed. A new high temperature fatigue test facility with unique capabilities has been developed. Effort was directed toward understanding multiaxial fatigue and correlating the experimental data to the existing theories of fatigue failure. The difficult task of predicting fatigue lives for nonproportional loading was used as an ultimate test for various life prediction methods being considered. The primary means of reaching improved understanding were through several critical nonproportional loading experiments. The direction of cracking observed on failed specimens was also recorded and used to guide the development of the theory. Cyclic deformation responses were permanently recorded digitally during each test. It was discovered that the cracking mode switched from primarily cracking on the maximum shear planes at room temperature to cracking on the maximum normal strain planes at 649 C. In contrast to some other metals, loading path in nonproportional loading had little effect on fatigue lives. Strain rate had a small effect on fatigue lives at 649 C. Of the various correlating parameters the modified plastic work and octahedral shear stress were the most successful. Author

N86-11527# Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 17, NO. 4 Monthly Report
Judith Nagle-Eshleman, ed. Apr. 1985 91 p refs
(AD-A154112) Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

Literature surveys of extensive shock and vibration research are presented. Finite element modeling of laminated composite plates is discussed. The use of the microcomputer as an effective tool for solving many shock and vibration problems is examined. A historical overview of mechanical face seal dynamics is presented. Book reviews presented in this digest reflect new computational testing techniques and design techniques, such as model testing and isolation system design. For individual titles, see N86-11528 through N86-11530.

N86-11528# Shock and Vibration Information Center (Defense), Washington, D. C.
MICROCOMPUTERS IN SHOCK AND VIBRATION
In its The Shock and Vibration Digest, Vol. 17, No. 4 Apr. 1985 p 1 (For primary document see N86-11527 02-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C., 20375 CSCL 20/11

The use of microcomputers for solving computational tasks in shock and vibration is examined. Some of the tasks included shock spectra computations, balancing of rotating shafts, acquisition and processing of materials properties data and spectral analysis. The increased power of the microcomputer is also significantly impacting shock and vibration analyses. Many problems that may have been previously run on mainframe computers, or minicomputers, are now small enough so they may be run on microcomputers with little, if any, loss in accuracy. Exploratory dynamic analyses of complex systems are often necessary, and this is another type of problem that might be run on a microcomputer. B.W.

N86-11529# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
A REVIEW OF THE LITERATURE ON FINITE-ELEMENT MODELING OF LAMINATED COMPOSITE PLATES c24
J. N. Reddy *In* Shock and Vibration Information Center The Shock and Vibration Digest, Vol. 17, No. 4 Apr. 1985 p 3-8 refs (For primary document see N86-11527 02-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C., 20375 CSCL 11/4

This review of the literature on the finite-element modeling of natural vibrations of plates is confined to the period from 1980 to the present. A historical background of the development of shear deformation theories is also presented. Author

N86-11530# Technion - Israel Inst. of Tech., Haifa. Dept. of Mechanical Engineering.
MECHANICAL FACE SEAL DYNAMICS UPDATE c37
I. Etison *In* The Shock and Vibration Information Center The Shock and Vibration Digest, Vol. 17, No. 4 Apr. 1985 p 11-15 refs (For primary document see N86-11527 02-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 11/1

This review is an update of literature published since 1981 on mechanical face seal dynamics. Experimental observations as well as theoretical analyses are summarized. Future research needs in mechanical face seal dynamics are pointed out. Author

N86-11531# Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 17, NO. 5 Monthly Report
Judith Nagle-Eshleman, ed. May 1985 102 p refs
(AD-A156716) Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

The Shock and Vibrating Digest is a monthly publication of the Shock and Vibration Information Center. Its goal is to provide efficient transfer of sound, shock, and vibration technology among researchers and practicing engineers. Subjective and objective analyses of the literature are provided along with news and editorial comment. For individual titles, see N86-11532 through N86-11533.

N86-11532# Yarmouk Univ., Irbid (Jordan). Dept. of Mechanical Engineering.
STIFFNESS AND DAMPING COEFFICIENTS OF RUBBER c27
M. Issa Abdulhadi *In* The Shock and Vibration Information Center Shock and Vibration Digest, Vol. 17, No. 5 May 1985 p 3-9 refs (For primary document see N86-11531 02-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 11/10

A study is carried out on a rubber pad (Neoprene GN) in the shape of a solid circular cylinder. The pad is subjected to a vibrating force. A mathematical model is used to evaluate stiffness and damping coefficients for the rubber and the damped energy. A heat conduction equation describing the temperature field in the rubber specimen is formulated; analytical results agree fairly well with temperatures measured in the rubber. Author

N86-11533# California Univ., Berkeley. Dept. of Mechanical Engineering.
CURRENT RESEARCH ON CIRCULAR SAW AND BAND SAW VIBRATION AND STABILITY
C. D. DAngelo, III, N. T. Alvarado, K. W. Wang, and C. D. Mote, Jr. *In* The Shock and Vibration Information Center The Shock and Vibration Digest, Vol. 17, No. 5 May 1985 p 11-23 refs (For primary document see N86-11531 02-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C., 20375 CSCL 20/11

Topics discussed are circular saw and band saw vibration; saw guides, which are fluid-film bearings used to control saw position and vibration; guided saw vibration; and generation of noise by vibration and aerodynamic sources in high-speed sawing. Author

N86-11534# Maryland Univ., College Park. Inst. for Physical Science andd Technology.
THIN PLATES WITH RAPIDLY VARYING THICKNESS, AND THEIR RELATION TO STRUCTURAL OPTIMIZATION Final Report
R. V. Kohn and M. Vogelius Champaign, Ill. Army Construction Engineering Research Lab. Jun. 1985 37 p Prepared in cooperation with Minnesota Univ., Minneapolis

(Contracts N00014-85-K-0169; N00014-83-K-0536; Grant NSF DMS-83-12229)
(AD-A157607; IMA-Preprint-155) Avail: NTIS HC A03/MF A01 CSCL 12/1

Mathematical models are described for plates with rapidly varying thickness; we place special emphasis on their relation to problems in optimal design. Our plate models extinguish between variations on a scale larger than the mean thickness, on a scale comparable to the mean thickness and on a scale smaller than the mean thickness. We review a number of theoretical results that compare the relative strengths of these three design options. The paper also contains exact numerical values for the rigidities of certain interesting plate profiles. These values were computed by a finite element method. GRA

N86-11535# UNC Nuclear Industries, Inc., Richland, Wash.
HARDWARE AND SOFTWARE CONSTRUCTS FOR A VIBRATION ANALYSIS NETWORK
S. A. Cook, R. D. Crowe, and H. Toffer 20 Feb. 1985 10 p Presented at tne Intern. Topical Meeting on Computer Appl. for Nucl. Power Plant Operation and Control, Pasco, Wash., 8 Sep. 1985
(Contract DE-AC06-76RL-01857)
(DE85-008436; UNI-SA-144; CONF-850903-4) Avail: NTIS HC A02/MF A01

Vibration level monitoring and analysis was initiated at N Reactor, a dual purpose reactor. The machinery to be monitored was located in several buildings scattered over the plant site, necessitating an approach using satellite stations to collect, monitor and temporarily store data. The satellite stations are, in turn, linked to a centralized processing computer for further analysis. The advantages of a networked data analysis system are discussed along with the hardware and software required to implement such a system. DOE

N86-11536# Massachusetts Inst. of Tech., Cambridge. Nuclear Reactor Lab.
MINIATURIZATION OF SPECIMENS FOR MECHANICAL TESTING
O. K. Harling and G. Kohse 17 Jun. 1985 30 p Presented at the Workshop on the Relation Between Mech. Properties and Micro-Struct. Under Fusion Irradiation Conditions, Ebeltoft, Denmark, 27 Jun. 1985
(Contract DE-AC02-78ER-10107)
(DE85-014506; DOE/ER-10107/28; CONF-8506165-1) Avail: NTIS HC A03/MF A01

The development of mechanical property tests based on bending of a 3 mm diameter by 0.25 mm thick disk is described. Slow strain rate testing of such a disk is used to obtain tensile properties. Finite element computer modeling is used to extract yield stress values with accuracies of at least + or - 10% of uniaxial tensile test values for a variety of materials. Analytical estimates of ductility from disk bend test values are possible for low-ductility materials. Work directed toward finite element calculations for ductility and ultimate tensile strength is also discussed. Preliminary data indicating the feasibility of high strain rate testing for estimation of ductile-to-brittle transition temperatures, and an example of the successful application of miniature bend testing in obtaining relative fatigue information are presented. DOE

N86-11537# Argonne National Lab., Ill.
SENSTIVITY OF USING BLUNT AND SHARP CRACK MODELS IN ELASTIC-PLASTIC FRACTURE MECHANICS
Y. C. Pan, J. M. Kennedy, and A. H. Marchertas 1985 16 p refs Presented at the 8th Intern. Conf. on Struct. Mech. in Reactor Technol., Brussels, 19 Aug. 1985
(Contract W-31-109-eng-38)
(DE85-010288; CONF-850809-49) Avail: NTIS HC A02/MF A01

J integral values are calculated for both the blunt (smeared) crack and the sharp (discrete) crack models in elastic-plastic fracture mechanics problems involving metallic materials. A sensitivity study is performed to show the relative strengths and weaknesses of the two cracking models. It is concluded that the blunt crack model is less dependent on the orientation of the mesh. For the mesh which is in line with the crack direction, however, the sharp crack model is less sensitive to the mesh size. Both models yield reasonable results for a properly discretized finite element mesh. A subcycling technique is used in the explicit integration scheme so that large time steps can be used for the coarse elements away from the crack tip. The savings of computation time by this technique are reported. DOE

N86-11538# Brown Univ., Providence, R. I. Div. of Engineering.
UNIAXIAL TENSILE DEFORMATION AND FRACTURE OF DUAL-PHASE STEELS
Y. L. Su Jul. 1985 211 p
(Contract DE-AC02-80ER-10556)
(DE85-015034; DOE/ER-10556/105) Avail: NTIS HC A1/MF A01

The photolithography technique was used to produce the microgrids on the specimen surface in order to study the difference in strain between the hard martensite particles and the soft ferrite matrix, and thus to determine the difference in stress between the two phases. Based on the stress-strain curves of dual phasae steels and direct observation of deformation of martensite particles and investigation of fracture behavior, analytical models were developed to explain the work hardening behavior and to formulate the expressions for uniform and fracture strains of dual phase steels. The results show that the uniform strain of dual phase steels is primarily decided by the properties and volume fraction of the ferrite, but the mechanism and strain of fracture of dual phase steels are determined by martensite. DOE

N86-11539# Argonne National Lab., Ill.
VISCOELASTIC CREEP OF HIGH-TEMPERATURE CONCRETE
P. A. Pfeiffer, A. H. Marchertas, and Z. P. Bazant 1985 13 p Presented at the 8th Intern. Conf. on Struct. Mech. in Reactor Technol., Brussels, 19 Aug. 1985 Prepared in cooperation with Northwestern Univ., Evanston, Ill.
(Contract W-31-109-eng-38)
(DE85-010511; CONF-850509-53) Avail: NTIS HC A02/MF A01

The analytical model for analysis of high temperature creep response of concrete is presented. The creep law used is linear (viscoelastic), the temperature and moisture effects on the creep rate and also aging are included. Both constant and transient temperature as well as constant and transient moisture conditions are considered. Examples are presented to correlate experimental data with parameters of the analytical model by the use of a finite element scheme. DOE

N86-11540*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
COMPUTATIONAL STRUCTURAL MECHANICS: A NEW ACTIVITY AT THE NASA LANGLEY RESEARCH CENTER
Norman F. Knight, Jr. and W. Jefferson Stroud Sep. 1985 39 p refs Presented at 22nd Ann. Tech. Meeting of the Soc. of Eng. Sci., University Park, Pa., 7-9 Oct. 1985
(NASA-TM-87612; NAS 1.15:87612) Avail: NTIS HC A03/MF A01 CSCL 20K

Complex structures considered for the late 1980's and early 1990's include composite primary aircraft structure and the space station. These structures will be much more difficult to analyze than today's structures and necessitate a major upgrade in computerized structural analysis technology. A new research activity in structural analysis, the computational structural mechanics (CSM) was initiated. The objective of the CSM activity is to develop advanced structural analysis technology that will exploit modern and emerging computers such as computers with vector and/or parallel processing capabilities. The three main research activities underway in CSM include: (1) structural analysis methods development; (2) a software testbed for evaluating the methods; and (3) numerical techniques for parallel processing computers. The motivation and objectives of the CSM activity are presented and CSM activity is described. The current CSM research thrusts, and near and long term CSM research thrusts are outlined. E.A.K.

N86-11541# Argonne National Lab., Ill.
EXPERIMENTAL NEEDS OF HIGH TEMPERATURE CONCRETE
J. C. Chern and A. H. Marchertas 1985 7 p Presented at 8th Intern. Conf. on Struct. Mech. in Reactor Technol., Brussels, 19 Aug. 1985
(Contract W-31-109-eng-38)
(DE85-009700; CONF-850809-35) Avail: NTIS HC A02/MF A01

The needs of experimental data on concrete structures under high temperature, ranging up to about 370 C for operating reactor conditions and to about 500 C and beyond for hypothetical accident conditions, are described. This information is required to supplement analytical methods which are implemented into the finite element code TEMP-STRESS to treat reinforced concrete structures. Recommended research ranges from material properties of reinforced/prestressed concrete, direct testing of analytical models used in the computer codes, to investigations of certain aspects of concrete behavior, the phenomenology of which is not well understood. DOE

N86-11542# Argonne National Lab., Ill.
CONCRETE CREEP AT TRANSIENT TEMPERATURE: CONSTITUTIVE LAW AND MECHANISM
J. C. Chern, Z. P. Bazant, and A. H. Marchertas 1985 13 p refs Presented at the 8th Intern. Conf. on Struct. Mech. in Reactor Technol., Brussels, 19 Aug. 1985 Prepared in cooperation with Northwestern Univ., Evanston, Ill.
(Contract W-31-109-eng-38)
(DE85-010525; CONF-850809-57) Avail: NTIS HC A02/MF A01

A constitutive law which describes the transient thermal creep of concrete is presented. Moisture and temperature are two major parameters in this constitutive law. Load, creep, cracking, thermal (shrinkage) strains, stress induced hygrothermal strains are analyzed. The theory agrees with most types of test data which include basic creep, thermal expansion, shrinkage, swelling, creep at cyclic heating or drying, and creep at heating under compression or bending. Examples are given to demonstrate agreement between the theory and the experimental data. DOE

N86-11543# Los Alamos Scientific Lab., N. Mex.
EVALUATION OF CONCRETE CREEP AND STRESS REDISTRIBUTION IN A PROTOTYPIC PCRV FOLLOWING RUPTURE OF PRESTRESSING TENDONS
E. Fugelso and C. A. Anderson 1985 13 p refs Presented at the 8th Intern. Conf. on Struct. Mech. in Reactor Technol., Brussels, 19 Aug. 1985
(Contract W-7405-eng-36)
(DE85-007673; LA-UR-85-638; CONF-850809-18) Avail: NTIS HC A02/MF A01

Numerical evaluation of the instantaneous and creep stress changes in a prototypic concrete PCRV subsequent to degradation and rupture of selected prestressing tendons is presented. Either partial or complete degradation of one prestressing tendon will slightly reduce the mean compressive stress in the same direction in the concrete. DOE

N86-11544# Sandia Labs., Albuquerque, N. Mex.
STRAIN RATE DEPENDENCE IN STEADY, PLASTIC SHOCK WAVES
J. E. Dunn and D. E. Grady 1985 7 p Presented at the Am. Phys. Soc. Topical Conf. on Shock Waves in Condensed Matter, Spokane, 22 Jul. 1985
(Contract DE-AC04-76DP-00789)
(DE85-014703; SAND-85-0635C; CONF-850736-20) Avail: NTIS HC A02/MF A01

The shock wave profile data of Barker for Al fits the empirical equation epsilon sub m = kp sub d to the 4th power. Attempts to understand the constitutive implications of the equation for the broader class of materials are summarized. DOE

N86-11545# Los Alamos National Lab., N. Mex.
MECHANICAL THRESHOLD OF DYNAMICALLY DEFORMED COPPER AND NITRONIC 40
P. S. Follansbee, U. F. Kock, and G. Regazzoni 1985 11 p Presented at the Intern. Conf. on Mech. and Phys. Behaviour of Mater. under Dynamic Loading, Paris, 2 Sep. 1985
(Contract W-7405-eng-36)
(DE85-010779; LA-UR-85-1135; CONF-850946-3) Avail: NTIS HC A02/MF A01

Measurements of the mechanical threshold, or threshold stress, are reported on quasi-statically and dynamically deformed copper and Nitronic 40. Results for copper show that the increase of the threshold stress with strain rate is similar to that of the flow stress. In Nitronic 40 the results show that the ratio of the flow stress to the threshold stress is approximately 0.6. Both results indicate that the increased rate sensitivity found in these materials at high strain rates is not due to the predominance of a viscous drag deformation mechanism, as has been previously suggested. DOE

N86-11546# Los Alamos National Lab., N. Mex.
INERTIA, STABILITY AND DUCTIBILITY IN UNIAXIAL TENSION AT HIGH STRAIN RATE
G. Regazzoni, P. S. Follansbee, and J. N. Johnson 1985 15 p Presented at the Symp. on Plastic Instability, Paris, 1 Sep. 1985
(Contract W-7405-eng-36)
(DE85-007671; LA-UR-85-632; CONF-850945-1) Avail: NTIS HC A02/MF A01

The influence of inertia on the necking process in the dynamic tensile test was studied. The equations of motion for a bar of finite length elongation dynamically were written assuming a one-dimensional state of stress, and a model for rate independent or rate dependent flow was presented. For rate dependent flow, a description of the stress-strain rate law that takes into account the increase of strain rate sensitivity in the dynamic range was introduced. The growth of an assumed perturbation located at the middle of the specimen was simulated with a finite difference code. Predictions of the model are compared with experimental results obtained on pure copper. E.A.K.

N86-11547# Sandia Labs., Albuquerque, N. Mex.
HIGH PRESSURE STRENGTH OF SHOCKED ALUMINUM
J. R. Asay, L. C. Chhabildas, G. I. Kerley, and T. G. Trucano 1985 5 p Presented at the Am. Phys. Soc. Topical Conf. on Shock Waves in Condensed Matter, Spokane, 22 Jul. 1985
(Contract DE-AC04-76DP-00789)
(DE85-014461; SAND-85-0157C; CONF-850736-15) Avail: NTIS HC A02/MF A01

Unloading wave experiments were used to determine the material strength and release adiabats in pure and 6061-T6 aluminum alloy over the stress range of 50 to 100 GPa. The experimental adiabats are in good agreement with theoretical calculations, assuming a constant rho(GAMMA). The strength measurements show that a maximum occurs for shock states above 20 GPa and that a general softening of the strength is evident between 40 and 100 GPa. DOE

N86-11548# Argonne National Lab., Ill.
EXPERIMENTAL STUDY ON IMPACT/FRETTING WEAR IN HEAT EXCHANGER TUBES
J. H. Cha, M. W. Wambsganss, and J. A. Jendrzejczyk Apr. 1985 56 p
(Contract W-31-109-eng-38)
(DE85-014597; ANL-85-38) Avail: NTIS HC A04/MF A01

A data bank of field experiences with heat exchanger tube vibration reveals numerous cases of tube failures at, or near, the baffle. Qualitative impact/fretting wear information for heat exchanger tubes through the performance of a series of tests involving the pertinent parameters were provided. They included: (1) force level, between the tube and its support; (2) tube to support plate hole clearance; (3) tube support plate thickness; and (4) tube vibration frequency. The characteristics of impact/fretting wear relative to tube motion pattern, material combination and surrounding fluid were also investigated. The test apparatus consists of a cantilevered tube with a simulated tube support plate at the free end. Tube vibration is induced by an electromagnetic exciter to simulate the flow induced tube motion occurring in a real heat exchanger at the tube/tube support plate interface. Tests

are conducted in air, water, and oil, all at room temperature. Wear rate increases significantly with the magnitude of the impact force between the tube and its support plate; the degree and trend of the wear rates are highly dependent on the mechanical and metallurgical properties of the tube/support material combination; the rate of impact/fretting wear decreases with increasing frequency. An empirical formula is proposed to correlate the experimental impact/fretting wear results. DOE

N86-11242*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
NONDESTRUCTIVE ULTRASONIC MEASUREMENT OF BOLT PRELOAD USING THE PULSED-PHASE LOCKED-LOOP INTERFEROMETER
S. G. Allison and J. S. Heyman *In its* Welding, Bonding and Fastening, 1984 Sep. 1985 p 197-209 refs (For primary document see N86-11227 02-23)
Avail: NTIS HC A21/MF A01 CSCL 20K

N86-11885# California Univ., Livermore. Lawrence Livermore Lab. Engineering Research Div.
FLEXIBLE VIBRATIONS OF A UNIFORM ELASTIC BEAM WITH ARBITRARY SUPPORTS AND LUMPED MASSES Abstract Only
Donald T. Gavel and Howard Woo *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 73 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

N86-12004# Joint Publications Research Service, Arlington, Va.
INVOLUTORY TRANSFORMATIONS AND VARIATION PRINCIPLES WITH MULTIVARIABLES IN THIN PLATE BENDING PROBLEMS Abstract Only
Weichang Qian *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-015) 16 May 1985 p 107 Transl. into ENGLISH from Yingyong Shuxue he Lixue (Chongquing), v. 6, no. 1, Jan. 1985 p 25-40 (For primary document see N86-11994 02-70)
Avail: NTIS HC A07/MF A01

N86-12005# Joint Publications Research Service, Arlington, Va.
NUMERICAL METHOD IN DYNAMIC RESPONSE OF NONLINEAR SYSTEMS Abstract Only
Zhaochang Zheng and Mingyi Tan *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-015) 16 May 1985 p 108 Transl. into ENGLISH from Yingyong Shuxue he Lixue (Chongquing), v. 6, no. 1, Jan. 1985 p 93-101 (For primary document see N86-11994 02-70)
Avail: NTIS HC A07/MF A01

N86-12009*# Naval Ship Research and Development Center, Bethesda, Md.
ON THE COMPUTATION OF STRUCTURAL VIBRATIONS INDUCED BY A LOW-SPEED TURBULENT FLOW Abstract Only
Y. F. Hwang *In* NASA. Lewis Research Center Numerical Tech. in Acoustics Oct. 1985 p 3-5 (For primary document see N86-12007 02-71)
Avail: NTIS HC A03/MF A01 CSCL 20K

N86-12010*# Houston Univ., Tex.
IMPROVING THE ACCURACY OF THE BOUNDARY INTEGRAL METHOD BASED ON THE HELMHOLTZ INTEGRAL Abstract Only
G. H. Koopmann and K. Brod *In* NASA. Lewis Research Center Numerical Tech. in Acoustics Oct. 1985 p 7-8 (For primary document see N86-12007 02-71)
Avail: NTIS HC A03/MF A01 CSCL 20K

42 GEOSCIENCES (GENERAL)

N86-11549# Academy of Sciences, Potsdam (East Germany). Zentralinst fuer Physik der Erde.
PROCEEDINGS OF THE 5TH INTERNATIONAL SYMPOSIUM GEODESY AND PHYSICS OF THE EARTH, PART 1
1985 177 p refs Symp. held in Magdeburg, East Germany, 23-29 Sep. 1984 3 Vol.
(Rept-81-Pt-1; ISSN-0514-8790) Avail: NTIS HC A09/MF A01
Numerous topics in planetary dynamics were presented. The Earth-Moon system, geodynamics, geodesy, Earth tides, Earth rotation, inverse problems in differential equations, geodetic boundary value problems, the modification of a tiltmeter to a borehole tiltmeter, and rheological parameters of the Earth are among the topics discussed. For individual titles, see N86-11550 through N86-11567.

N86-11550# Academy of Sciences, Potsdam (East Germany). Zentralinst. fuer Physik der Erde.
FIGURE OF THE EARTH, MOON, AND PLANETS Progress Report, 1981-1984 c90
M. Bursa *In its* Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth 1985 p 10-24 refs (For primary document see N86-11549 02-42)
Avail: NTIS HC A09/MF A01
Numerous topics related to the celestial mechanics of the Sun, Moon and Earth are briefly discussed as studies by a number of authors are briefly surveyed. Orbital, rotational, and tidal dynamics of systems of celestial bodies; representation of gravitational fields of celestial bodies; gravity field parameters of Earth, Moon and planets; the boundary value of Mododensky; and density models of the Earth are discussed. R.J.F.

N86-11551# Research Inst. of Geodesy, Prague (Czechoslovakia).
RESULTS OF KAPG CO-OPERATION IN EARTH TIDE RESEARCH c48
Zdenek Simon *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth 1985 p 24-30 refs (For primary document see N86-11549 02-42)
Avail: NTIS HC A09/MF A01
Joint Earth tide measurements with Askania gravimeters were conducted on the stations Pulkovo, Obninsk (USSR), Potsdam (GDR), Pecny (Czechoslovakia), Tihany (Hungary) and Sofia (Bulgaria). For the tidal analysis Venedikov's method M 74 was used. In contradiction with the high inner accuracy, systematic differences were found between the results of individual series of measurements on the same station, first of all in gravimetric factors delta. These differences occur sometimes also between the results obtained with the same gravimeters. The mean square value of the systematic error of delta values from one series caused by the record calibration imperfection, is s sub delta = 0.0064. For the real random mean square error of the main waves the value sigma sub delta = 0.0043 was found. With the phase lags chi there is s sub chi = 26 omega (omega - angular speed in o over s) and = 0.36 degrees. An improvement of the real accuracy of the results of gravimetric Earth tide measurements is possible either by increasing the number of measured series on the station or, more effectively, by improvement of the measuring techniques. R.J.F.

N86-11552# Martin Luther-Universitaet, Halle-Wittenberg (East Germany). Sektion Mathematik.
ON INVERSE PROBLEMS IN DIFFERENTIAL EQUATIONS: A CRITICAL ANALYSIS c64
Gottfried Anger *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth 1985 p 38-44 refs (For primary document see N86-11549 02-42)
Avail: NTIS HC A09/MF A01
The author has conducted fundamental research in potential theory, partial differential equations, and functional analysis for 20 years, concentrating on the systematic study of the natural coupling between physical fields and modern analysis. For the past 14 years he has applied the results obtained to the study of inverse problems. He has encountered serious difficulties in this

task, since, apart from the inverse spectral problem, no effective general formulation of this class of problems was available and no useful theories have been developed for coping with them. The author discusses the problem encountered in his investigations. Author

N86-11553# Academy of Sciences, Potsdam (East Germany). Zentralinst. fuer Physik der Erde.
NEW ASPECTS OF THE GEODETIC BOUNDARY VALUE PROBLEMS **c43**
K. Arnold *In its* Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth 1985 p 45-50 refs (For primary document see N86-11549 02-42)
Avail: NTIS HC A09/MF A01

At first, the solution of the boundary value problem of Molodensky is considered. The identity of Green and the smoothing superposition with the visible mountain masses lead to a closed solution which does not involve series developments and instable downward continuations. The negligible remainder term has a mathematical expression that gives an insight of clear transparency into its amount. Further, the first mixed boundary value problem of geodesy is investigated. The potential values at the oceans and the free air anomalies at the continents are the boundary values. The solution consists in a representation of the potential values at the continents in terms of the boundary values. The kernel of the concerned integral equation of the first kind is symmetric, positive definitie and closed. Thus, it allows a bijective mapping. A condition for the uniqueness is derived for an arbitrary course of the coastline. Four compatibility conditions for the boundary values are found. They must be fulfilled if the solution is in the subspace of the harmonics of 2nd and higher order only. Author

N86-11554# Hungarian Academy of Sciences, Sopron. Geodetical and Geophysical Research Inst.
HIGH FREQUENCIES IN TIDAL TILT RECORDS **c48**
G. Bartha *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth 1985 p 51-59 refs (For primary document see N86-11549 02-42)
Avail: NTIS HC A09/MF A01

A new type of horizontal pendulum was developed, where the motion of the beam is detected by a capacitive sensor. A possibility of dense sampling is provided by this technique. Therefore, higher frequencies than the tidal ones could be studied. The periods of the Earth's normal modes excited by big earthquakes can be found from some minutes till near one hour. Their detection was strongly hoped with the new horizontal pendulum. The free oscillation phenomenon is discussed from this aspect. Some results, produced from data series sampled densely after earthquakes, are also shown. Author

N86-11555# Institut Geographique National, Paris (France). Groupe de Recherches de Geodesie Spatiale.
ESTABLISHMENT OF THE BIH TERRESTRIAL SYSTEM BY COMBINING THE RESULTS OF DIFFERENT EARTH ROTATION SPACE GEODESY PROGRAMS Abstract Only **c43**
Claude Boucher and Martine Feissel (Observatoire de Paris) *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth 1985 p 60 (For primary document see N86-11549 02-42)
Avail: NTIS HC A09/MF A01

The application of space geodesy techniques to global geodesy problems has resulted in the precise determination of positions of several tens of sites where stations are operated for Earth rotation observing programs. These sites are organized in networks, for which consistent ensembles of Sets of Stations Coordinates (SSC) and series of the Earth's rotation parameters (ERP) are obtained by analysis centers specializing in the treatment of Doppler Lacking satellite or Lunar laser ranging, and VLBI. More than ten such ensembles are presently available. The simultaneous use of the SSC and the series of ERP, constrained by common site coordinates for colocated stations, makes it possible to realize a worldwide terrestrial frame, and a series of ERP consistent with it. Starting with 1984, the terrestrial frame of the BIH will be realized along this ideas, by the method described in [C. Boucher and M. Feissel, Realization of the BIH terrestrial system, Proc. of the Internat. Symp. Space Techniques for Geodynamics, held in Sopron (Hungary), 9 to 13 July 1984]. The continuity of the orientation of the new frame with respect to the previous realization of the BIH System will be insured within 0.005 inches. The precision of site coordinates will be in the range 10 to 100 cm, depending on the observing technique operated at the site. Author

N86-11556# Ceskoslovenska Akademie Ved, Prague. Astronomical Inst.
TIDAL FRICTION, THE EARTH'S ROTATION AND HYPOTHESIS OF AN EXPANDING EARTH **c43**
Milan Bursa *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth 1985 p 61-67 refs (For primary document see N86-11549 02-42)
Avail: NTIS HC A09/MF A01

It has been demonstrated that the observed decreasing of the second zonal harmonic in the geopotential and of the angular velocity of the Earth's rotation affects its dynamics significantly. The tidal budget angular momentum equation of the Earth-Moon-System is well satisfied using recent data. There is no space for the hypothesis of an expanding Earth, as well as, for secular variations in the Newtonian gravitational constant. Author

N86-11557# Zagreb Univ. (Yugoslavia). Geodetic Faculty.
ANEW ABOUT THE CORRELATION BETWEEN MOHOROVICIC DISCONTINUITY DEPTHS, GEOID UNDULATIONS AND BOUGUER GRAVITY ANOMALIES IN THE DINARIC-PANNONIAN REGION OF YUGOSLAVIA **c46**
K. Colic, S. Petrovic, and T. Basic *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth 1985 p 68-76 refs (For primary document see N86-11549 02-42)
Avail: NTIS HC A09/MF A01

The continuation and the expansion of the preliminary investigations of the linear correlation between Mohorovicic discontinuity depths M and the absolute geoid undulations N (obtained from astrogeodetic and GEM 10 data) are depicted, as well as Bouguer gravity anomalies delta g in the Dinaric-Pannonian region of Yugoslavia. At this stage, an attempt was made to modify the numerical treatment. Also, a fresh deep seismic sounding profile, situated on the border of Alps massif, was included into research. Thus, it became possible for the considered region, a region which frequently shows a high degree of seismic activities, to test the relations which had been obtained previously, as well as to achieve some new interesting results in the field of M-depths predicition. Author

N86-11558# Academy of Sciences, Potsdam (East Germany). Zentralinst. fuer Physik der Erde.
AN ATTEMPT TO DETECT GEOMETRIC TIDAL INFORMATION USING LAGEOS LASER RANGING DATA **c48**
R. Dietrich and G. Gendt *In its* Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth 1985 p 77-81 refs (For primary document see N86-11549 02-42)
Avail: NTIS HC A09/MF A01

Usually, in satellite geodesy, the solid earth tide effects are computed as corrections to the station coordinates. Here the Love number h was introduced as an unknown parameter into the adjustment process. Computations with the orbital program POTSDAM-5 and the data of MERIT Short Campaign led to values of h = 0.56 plus or minus 0.06 (gravity field model GEM-L2) and h = 0.55 plus or minus 0.06 (gravity field model GRIM 3B). Author

N86-11559# Academy of Sciences, Potsdam (East Germany). Zentralinst. fuer Physik der Erde.
SOME RESULTS OF AN EIGHT YEARS GRAVIMETRIC REGISTRATION SERIES **c46**
H.-J. Dittfeld *In its* Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth 1985 p 82-91 refs (For primary document

see N86-11549 02-42)
Avail: NTIS HC A09/MF A01

Digital Earth tide records have been carried out since March 1974 at the Potsdam Gravimetric Observatory using the Askania gravimeter GS15 No. 222. Analyzed are 63,341 hourly readings, measured until February 1982. The inner accuracy of the main tidal amplitude factors is + or - 0.0002 + or - 0.0009, that of the phase + or - 0.01 + or - 0.04. The mean square error of an hourly reading was m sub o = + or - 0.66 microgal. The final results for the entire series are compared with model values. Temporal variations of the tidal parameters are determined by overlapping partial analyses of more than 10,000 readings. The results are compared with those of corresponding data of the Earth tide station Pecny/CSSR. In both the series of a significant increase of the 01 amplitude is detected for the same time interval in which a decrease of the length of the day was obtained by the BIH (Bureau Internationale de e'Houre). Author

N86-11560# Deutsches Geodaetisches Forschungsinstitut, Munich (West Germany).
GEOPHYSICAL INTERPRETATION OF GLOBAL GEOID UNDULATIONS AND MEAN GRAVITY ANOMALIES **c46**
Hermann Drewes *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth 1985 p 95-104 refs (For primary document see N86-11549 02-42)
Avail: NTIS HC A09/MF A01

Global representations of geoid and gravity anomalies are discussed with respect to their evidence for the mass distribution inside the Earth. Two methods can be used: The first one starts from the distribution of inhomogeneous masses as known from geophysics. The effect of these masses on the gravitational potential and gravity is computed and compared with the geodetically determined parameters. The second method applies a least squares adjustment approach to estimate the inhomogeneous mass distribution from the observed geoid and gravity representations. For the latter inversion procedure a new algorithm and application is given. Author

N86-11561# Technische Hochschule, Darmstadt (West Germany). Inst. fuer Physikalische Geodaesie.
PRECISE GEOID COMPUTATIONS AT MOUNTAINOUS COASTLINES IN VIEW OF VERTICAL DATUM DETERMINATIONS **c43**
H. J. Euler, E. Groten, W. Hausch, and B. Stock *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth 1985 p 109-139 refs (For primary document see N86-11549 02-42)
Avail: NTIS HC A09/MF A01

Problems inherent in precise geoid determination are considered. Conceptional ideas about the vertical datum problem are presented. Geophysical considerations and spherical spline interpolations are carried out in a test area. Truncation error coefficients for the altitude-extended Hotline function in form of recurrence relations are derived. The ellipsoidal corrections for the geoid undulation and the deflections of the vertical as well as the atmospheric correction to geoid undulations are determined with spherical harmonic models up to degree 180. Author

N86-11562# Agricultural Univ., Wroclaw (Poland). Dept. of Geodesy and Photogrammetry.
ADJUSTMENT OF THE LATITUDE DATA BY LEAST-SQUARES COLLOCATION APPROACH **c64**
R. Galas *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth 1985 p 139-141 refs (For primary document see N86-11549 02-42)
Avail: NTIS HC A09/MF A01

To solve the problem of intercomparison of the polar motion data on the base of various space and astrometric techniques, many basic problems must be discussed. Among them, the proper algorithms for smoothing of the observational data should be evaluated. At the outset the stochastic-deterministic model of the latitude variations and of the polar motion is presented. Then the empirical covariance functions are defined and positive definiteness of the respective covariance matrices is checked out. Finally, smoothing of the observational series of the latitude variations by the least-squares collocation is discussed. Author

N86-11563# Technische Hochschule, Darmstadt (West Germany). Inst. fuer Physikalische Geodaesie.
MODIFICATION OF A HUGHES TILTMETER TO A BOREHOLE TILTMETER **c35**
C. Gerstenecker *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth 1985 p 142-149 refs (For primary document see N86-11549 02-42)
Avail: NTIS HC A09/MF A01

Earth tidal tilt measurements in mines are influenced by cavity effects. Therefore, the modification of tiltmeters to borehole instruments is useful, since the cavity effect may be avoided in boreholes. The principle of the design of the Hughes tiltmeter and of borehole equipment is described. The diameter of the borehole case is similar to that of the Askania vertical pendulum. Hence the Hughes tiltmeter can be installed in boreholes drilled for Askania pendulums. To achieve proper operation of the instrument, the electronics had to be reconstructed and integrated in the borehole case. Devices for remote adjustment of the tiltmeter in the borehole, self test, temperature, and air pressure sensors complete the borehole equipment. The borehole tiltmeter is connected via a 60 m long cable with the control unit, containing the necessary power supplies, analog control instruments and adjustment knobs. Author

N86-11564# Technische Hochschule, Darmstadt (West Germany). Inst. fuer Physikalische Geodaesie.
ON THE DISTRIBUTION OF THE RESIDUAL VECTORS OF EARTH'S TIDE GRAVITY OBSERVATIONS IN CENTRAL EUROPE **c46**
C. Gerstenecker and P. Varga (Budapest Science Univ.) *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth 1985 p 150-165 refs (For primary document see N86-11549 02-42)
Avail: NTIS HC A09/MF A01

Residual vectors of Earth tidal gravity observations should give information about inhomogenities in the Earth's crust, if all error sources such as tidal load vectors, instrumental nonlinearities and instabilities are compensated. Results of observations at 13 different stations in Central Europe with the LaCoste-Romberg Earth tide meter ET 16 are compared with residual vectors obtained at neighbor stations with other gravimeters such as Askania GS-15 and Geodynamics. The phase angles distribution obtained points out a significant correlation between the individual stations, which is independent of the instruments used, but no correlation with the thickness of the lithosphere. The behavior of the residual vectors proposes the existence of a common noise source. The reasons are mainly seen in the load tide calculation, which may be systematically biased up to 0.3 microgal with regard to amplitude. Author

N86-11565# Academia Sinica, Beijing (China). Inst. of Geodesy and Geophysics.
ON THE LUNAR TIDAL EFFECT IN THE LATITUDE OBSERVATIONS AT TIANJIN **c46**
Tianqi Han, Yiming Qian, Shiguang Li, and Lanzhen Ma *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth 1985 p 166-168 refs (For primary document see N86-11549 02-42)
Avail: NTIS HC A09/MF A01

The effects of the lunar tides on the latitude observation results of 25260 star pairs with the zenith telescope ZTL-180 at Tianjin Latitude Station during 1960-1966 are analyzed. It is found that the amplitude of the M2 tidal wave is 0'.0108, and the value of 1+k=1 is 1.34. When the effects of the ocean tides are removed, the value of 1+k-1 is reduced to 1.315, which shows good consistency with the value 1.31 given by geophysicists to the Asian area. F.M.R.

N86-11566# Slovak Technical Univ., Bratislava (Czechoslovakia). Observatory.
SOME SHORT PERIODIC TERMS DUE TO NUTATION AND TIDES FROM LATITUDE AND TIME DETERMINATIONS AT CZECHOSLOVAK OBSERVATORIES **c46**
Jan Hefty *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth 1985 p 169-172 refs (For primary document see N86-11549 02-42)
Avail: NTIS HC A09/MF A01

The latitude factor lambda = 1 + k =- 1 and gamma, the ratio of observed to theoretical nutation of a rigid Earth, is estimated. For the analysis of observations by three instruments the Photographic Zenith Telescope (PZT), circum-zenithal and visual transit instruments - two independent methods are used. Results are consistent with Wahr's model of forced nutations and the theory of body tides. F.M.R.

N86-11567# Academy of Sciences, Potsdam (East Germany). Zentralinsts fuer Physik der Erde.
RESULTS CONCERNING RHEOLOGICAL PARAMETERS OF THE EARTH **c43**
Joachim Hoepfner *In its* Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth 1985 p 173-176 refs (For primary document see N86-11549 02-42)
Avail: NTIS HC A09/MF A01

Using the mean Chandler period obtained from latitude observations at the astrolab in Potsdam, the deformation factor k sub d and from this the Love number k is computed. Furthermore, the heterogeneities of k sub d and k are estimated. The contribution to the Chandler period for anelasticity in the Earth's mantle is determined by comparison with a theoretical Chandler period corrected for the influence of the polar tide. Author

N86-11568# Academy of Sciences, Potsdam (East Germany). Zentralinst. fuer Physik der Erde.
PROCEEDINGS OF THE 5TH INTERNATIONAL SYMPOSIUM GEODESY AND PHYSICS OF THE EARTH, PART 2
1985 161 p refs In ENGLISH and RUSSIAN Symp. held in Magdeburg, East Germany, 23-29 Sep. 1984 3 Vol.
(Rept-81-Pt-2; ISSN-0514-8790) Avail: NTIS HC A08/MF A01

Geodesy and earth physics were discussed. Topics presented include: solving geodetic boundary value problems for topography, irregularity in the Earth's annual rotation caused by time variation, ocean tidal loading, coupling torques between the Earth's core and mantle on Earth rotation parameters, periodical variations of polar motion, oceanic and gravity interactions, convergence problems of satellite derived spherical harmonic expansion of the geopotential at Earth's surface, geodynamic effects due to Earth's deformation, comparisons between formulas of Earth's tidal correction in astronomical time and latitude observation, inelasticity the Earth mantle. For individual titles, see N86-11569 through N86-11590.

N86-11569# Research Inst. of Geodesy, Prague (Czechoslovakia).
A NEW APPROACH TO ITERATIONS IN SOLVING GEODETIC BOUNDARY VALUE PROBLEMS FOR REAL TOPOGRAPHY **c43**
Petr Holota *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 2 1985 p 4-15 refs (For primary document see N86-11568 02-42)
Avail: NTIS HC A09/MF A01

A geodetic boundary value problem means to find a harmonic function in the domain outside a telluroid which meets conditions given on the surface of the telluroid. Following the definition, the telluroid or the surface of the Earth in the first approximation is as irregular as the physical surface of the Earth's body. However, almost all formulas which are used for practical representation of the solution of the problem are valid for what is a zero-order approximation of the solution based on a formal approximation of the real boundary surface by a sphere. This spherical approximation is habitual in the computations when it is used even at a high smoothing of the real topography. It is suggested that there is a convergent iterative process, an analytical centinuation in the interpretation which modifies the original boundary data. The simple molodensky problem is discussed. It is concluded that there is a need for a good starting approximation, which is identical with the Stokes integral. The Stokes approximate solution of the molodensky problem is the basis in the sequence of approximations of the iterative process. Author

N86-11570# Higher Inst. of Mining and Geology, Sofia (Bulgaria).
THE IRREGULARITY IN THE EARTH'S ANNUAL ROTATION AS A CAUSE OF SYSTEMATIC TIME VARIATION **c43**
I. B. Ivanov *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 2 1985 p 16-18 refs (For primary document see N86-11568 02-42)
Avail: NTIS HC A09/MF A01

Seasonal variations in the Earth's rotational velocity phi were established and it was pointed out that they are causes of meteorological factors. The effect of the meteorological factors, can explain only about half on the observed values of these seasonal variations the unexplained 50% of the values of these seasonal variations in the Earth's angular velocity are outlined. The transport of masses through the equatorial plane were established. The angular moment of a rotational body is presented. E.A.K.

N86-11571# Freie Univ., Berlin (West Germany). Inst. fuer Geophysikalische Wissenschaften.
OCEAN TIDAL LOADING ALONG THE BLUE ROAD GEOTRAVERSE IN FENNOSCANDIA **c48**
Gerhard Jentzsch *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 2 1985 p 18-28 refs (For primary document see N86-11568 02-42)
Avail: NTIS HC A09/MF A01

Gravity tidal measurements along the Fennoscandian Blue Road Geotraverse are presented. The residual vectors for consituents O1 and M2 are compared to ocean tidal loading, and calculated for modified Schwiderski maps. The coherence of the results for O1 shows the sufficient intercalibration of the different gravimeters. The results for M2 indicate that an improvement of the models for the spatial distribution of the marine tide of the Norwegian shelf has to be applied to fit the observed residuals near the coast. Data acquisition of the gravimeters, calibration, and data analysis are discussed. E.A.K.

N86-11572# Academy of Sciences, Potsdam (East Germany). Zentralinst. fuer Physik der Erde.
ON THE INFLUENCE OF COUPLING TORQUES BETWEEN THE EARTH'S CORE AND MANTLE ON PARAMETERS AND COMPONENTS OF THE ROTATION OF THE EARTH **c46**
H. Jochmann *In its* Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 2 1985 p 29-31 refs (For primary document see N86-11568 02-42)
Avail: NTIS HC A09/MF A01

The physical reliability of correlations between magnetic field quantities and components and parameters of the Earth's rotation was investigated. It is found that only the correlations between variations of the magnetic field intensities and of the length of day are physically significant, while the correlations between the magnetic field and parameters of the CHANDLER-wobble are dubious. E.A.K.

N86-11573# Technische Univ., Dresden (East Germany).
TREATMENT OF THE GEODETIC BOUNDARY VALUE PROBLEM BY CONTACT-TRANSFORMATION **c64**
Wolfgang Keller *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 2 1985 p 32-35 refs (For primary document see N86-11568 02-42)
Avail: NTIS HC A09/MF A01

Free boundary value problems for elliptical differential equations were studied use by use of the searched function V for the definition of a contact-transformation. This contact-transformation transforms the free boundary value problem for V into a boundary value problem with fixed boundary for a coordinated function psi. This approach was examined and the application of this principle in

geodesy goes back to Sanso. The most simple case of a contact-transformation, is applied to Legendre's transformation.
Author

N86-11574# Polish Academy of Sciences, Warsaw. Space Research Centre.
ON SHORT PERIODICAL VARIATIONS OF POLAR MOTION AND UT1-UTC **c43**
B. Kolaczek, A. Brzezinski, W. Kosek, J. Nastula, and B. Soloducha *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 2 1985 p 35-44 refs (For primary document see N86-11568 02-42)
Avail: NTIS HC A09/MF A01

The MERIT data of pole coordinates, UT1-UTC and l.o.d. from the period between October 1983 to July 1984 were used to analysis spectra of their variations in the short periodical part from 10 to 90 days by the Maximum Entropy Spectral Analysis (MESA). A few short periodical variations detected by MESA in all series of data determined by different techiques seem to be real short periodical variations of the order of a few miliarcseconds only, are weakly determined, and they can be changeable. E.A.K.

N86-11575# Academy of Sciences, Potsdam (East Germany). Zentralinst. fuer Physik der Erde.
INFLUENCES OF SYSTEMATIC DIFFERENCES BETWEEN DIFFERENT STAR CATALOGUES ON THE RESULTS OF LATITUDE AND TIME DETERMINATIONS WITH THE PZT 2 **c89**
M. Mainig *In its* Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 2 1985 p 45-54 refs (For primary document see N86-11568 02-42)
Avail: NTIS HC A09/MF A01

Systematic errors in the star catalogues, used for the reduction of Photographic Zenith Telescope PZT observations, effect directly the results of latitude and time determinations and the Earth rotation parameters which were derived from these results. In the geodetic-astromical observatory of the Central Institute for Physics of the Earth the catalogue PZT 80 is used. The catalogue contains star places, which were improved by own PZT results. The systematic differences between this catalogue and the catalogue of northern PZT stars NPZT 74 are approximated by analytical expressions in dependence on the right ascension. The influence of these differences on the latitude and time determinations is presented for the observation series with the PZT 2 in the years 1981 to 83. The obtained results are compared with values calculated from data of the Bureau International de l'Heure. E.A.K.

N86-11576# Belgian Royal Observatory, Uccle.
INTERACTIONS BETWEEN OCEANIC AND GRAVITY TIDES, AS ANALYSED FROM WORLD-WIDE EARTH TIDE OBSERVATIONS AND OCEAN MODELS **c48**
P. Melchior, B. Ducarme, M. VanRuymbeke, C. Poitevin, and M. DeBecker *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 2 1985 p 55-62 refs (For primary document see N86-11568 02-42)
Avail: NTIS HC A09/MF A01

Interactions between earth tides and oceanic tides involves effects of newtonian attraction, loading and associated change of earth potential, tangential pressure and friction on the moving ocean floor. The following two facts were applied: a considerable amount of data from 223 stations including those of the Trans World Profiles were evaluated, which a Worldwide distribution including the tropical areas and the southern hemisphere; (2) in 1978 to 80, new oceanic cotidal maps of high quality became available. Eight principal tidal waves were calculated for the correlations between the observed gravity variations and those resulting from a calculation based upon the Schwiderski maps. These cotidal maps can be used as working standards for other geodetic and geophysical applications. E.A.K.

N86-11577# Hungarian Academy of Sciences, Sopron. Geodetical and Geophysical Research Inst.
CAPACITIVE PENDULUM WITH INTELLIGENT DATA COLLECTION **c35**
Gy. Mentes *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 2 1985 p 63-69 refs (For primary document see N86-11568 02-42)
Avail: NTIS HC A09/MF A01

The improvement of horizontal pendulums in geodynamic measuring techniques. Coventional recording systems are not convenient for geodynamic phenomena, and a new capacitive horizontal pendulum with electric output and an intelligent digital data recorder was constructed. For the reproduction of the original signal this latter also uses logical decisions besides mathematical filtering of the data. Analog recording can be abandoned and it is not necessary to store all sampled data. The recorder can be programmed for various tasks. E.A.K.

N86-11578# Academia Sinica, Beijing (China). Inst. of Geodesy and Geophysics.
RESEARCH ON THE COMPUTATIONAL METHODS OF GRAVITY TOPOGRAPHIC EFFECT **c46**
Jiachun Meng *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 2 1985 p 70-77 refs (For primary document see N86-11568 02-42)
Avail: NTIS HC A09/MF A01

Methods for computing the gravity topographic effect are presented. These methods include: topographic correction solution C are shown, MOLODENSKY's series solution G1, PELLINEN's formula G', analytic continuation g sub and BOERHAMMAR's solution. The interrelation between the formulas of topographic correction are shown the relation between the analytic continuation solution and BOERHAMMAR's solution are derived and some of their natures are deduced. In these methods, each has a common operator L. A certain connections with each other exists, but they can not be replaced mutually. The linear solution of analytic continuation solution is respectevely the approximates value of MOLODENSKY's series solution G1 and BOERHAMMAR'S solution. This suggested that these of reduction of separated rings may decrease difficulties brought about in iterative computation.
E.A.K.

N86-11579# Academy of Sciences (USSR), Moscow.
THE POTENTIALOGRAPHICAL PROBLEM AND THE CONCEPTION OF GRAVITATING DISKS **c46**
G. A. Meshcheryakov *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 2 1985 p 78-87 refs In RUSSIAN; ENGLISH summary (For primary document see N86-11568 02-42)
Avail: NTIS HC A09/MF A01

Two approaches to the Potentialographical Problem (PP) for solving the problems of convenient analytical representation of external potential planet gravitation are presented. The first one corresponds to known methods of solution of direct PP. The second is a constructive one; it presents inverse PP, which is a new kind of inverse problems of potential theory. The inverse PP in which a known potential of the planet is represented as sums of potentials of the simple and double layers, situated on the given surface in the interior of the planet is presented. The density and moments of these layers are sought. A particular case of this problem, when layers are supposed to be in the equatorial plane, brings about the conception of gravitating disks CGD. According to CGD potential of planet is represented as the sum of three potentials of the plane circular one centered disks: focal disks - FD, material, massless MMD and kipole disk - DD. Author

N86-11580# Technische Univ., Graz (Austria). Inst. of Theoretical Geodesy.
VARIATIONAL PRINCIPLES FOR EARTH ROTATION **c43**
Helmut Moritz *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 2 1985 p 88-101 refs (For primary document see N86-11568 02-42)
Avail: NTIS HC A09/MF A01

Hamilton's principle of least action, in the form of Lagrange's equations, was applied to the rotation of a rigid earth, and to the rotation of an elastic earth with a liquid core. In the form of Hamilton's canonical equations it was applied to a rigid earth.

Modified Lagrange's equations, using nonholonomic group variables, were applied to the rotation of a rigid mantle with a homogeneous liquid core. This equation was applied to the rotation of the earth model (elastic mantle and liquid core), which results in extremely simple equations derived in a different way. Since the rotation of a rigid earth is well known, the classical approach, using holonomic variables, and, in more detail, the recent approach through equations using nonholonomic variables related to rotation groups are discussed. Author

N86-11581# Stazione Astronomica Internazionale di Latitudine, Cagliari (Italy).
SECULAR AND LONG TERM VARIATIONS IN POLAR MOTION FROM CLASSICAL AND DOPPLER OBSERVATIONS c43
A. Poma and E. Proverbio (Ist. di Astronomia e Fisica Superiore, Cagliari, Italy) *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 2 1985 p 101-108 refs (For primary document see N86-11568 02-42)
Avail: NTIS HC A09/MF A01

The existence of secular and low frequency variations in the spectrum of polar motion was reported in a large number of works and discussed by several authors. However, the reality and the geophysical and/or meteorological causes of these phenomena are still a matter of discussion chiefly because the only long series of pole coordinates are essentially the ones based on the results of the five ILS stations. The comparison of classical series (ILS and BIH) of polar coordinates with those derived from Doppler observations lead to the emphasizing of some characteristic features in the secular polar motion in accordance with the crustal motion model. Author

N86-11582# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Geodesy.
ON THE CONVERGENCE PROBLEM OF THE SATELLITE DERIVED SPHERICAL HARMONIC EXPANSION OF THE GEOPOTENTIAL AT THE EARTH'S SURFACE c46
Lars E. Sjoeberg *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 2 1985 p 108-114 refs (For primary document see N86-11568 02-42)
Avail: NTIS HC A09/MF A01

The problem of downward continuing a satellite derived series of spherical harmonics of the Earth's gravity field to the surface is considered. An error formula is derived. Despite extensive numerical study it is concluded that the error of a high degree harmonic expansion (N > or = 300) is not yet satisfactorily known. Author

N86-11583# Academy of Sciences, Potsdam (East Germany). Zentralinst. fuer Physik der Erde.
ON THE COMPARISON OF THE RESULTS OF TWO DIFFERENT E-W-STRAINMETERS c35
D. Simon, R. M. Karmaleeva (Academy of Sciences (USSR), Moscow), and L. A. Latynina (Academy of Sciences (USSR), Moscow) *In its* Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 2 1985 p 115-125 refs (For primary document see N86-11568 02-42)
Avail: NTIS HC A09/MF A01

The possible application of tidal strainmeters for measurements of recent crustal movements is discussed. The records of two E-W-strainmeter of different type were analyzed. The instruments are measuring since 1978 simultaneously at the Tiefenort station, 5 meters distant from each other. G.L.C.

N86-11584# Technische Univ., Dresden (East Germany). Sektion Geodaesie und Kartographie.
PLANETS AROUND BARNARD'S STAR? c89
Klaus-Guenter Steinert *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 2 1985 p 126-128 refs *Its* Mitteilung des Lohrmann-Observatoriums No. 52 (For primary document see N86-11568 02-42)
Avail: NTIS HC A09/MF A01

From analyses of long focus observations unseen objects may be found from perturbations in the proper motions of a star. The question is discussed under what conditions it should be possible to detect planets around the nearby Barnard's star. G.L.C.

N86-11585# Ceskoslovenska Akademie Ved, Prague. Geophysical Inst.
GEODYNAMIC EFFECTS DUE TO EARTH'S DEFORMATION c43
Jiri Tresl *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 2 1985 p 128-133 refs (For primary document see N86-11568 02-42)
Avail: NTIS HC A09/MF A01

Some geodynamic effects arising due to deformation of the Earth are investigated. In undeformed state the Earth is replaced by a sphere with radially depending density. Its deformed state is described by displacement vector field. Corresponding density disturbances are expressed in terms of the density and displacements. Further, displacement vector field is decomposed into irrotational and solenoidal parts. Gravitational changes on the Earth's surface are composed from: (1) the changes due to density disturbances inside the Earth; (2) the changes due to deformations of the density interfaces; and (3) the changes due to radial displacement of the observational point. Mathematical expression are derived for the deflections of the vertical, the displacements of the principal axes of inertia, the changes of Earth's rate of rotation and its center of gravity in terms of the density disturbances. G.L.C.

N86-11586# Geodetic Inst., Charlottenlund (Denmark).
ON THE LONG-WAVELENGTH CORRELATION BETWEEN GRAVITY AND TOPOGRAPHY c46
C. C. Tscherning *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 2 1985 p 134-143 refs (For primary document see N86-11568 02-42)
Avail: NTIS HC A09/MF A01

Spherical harmonic expansions of the topography, the topographic isostatic reduction potential and the gravity potential of the Earth now exist complete to degree (N) and order 180. A correlation analysis of the various fields by degree was made. While the general correlation between gravity and topography for the sets is around 50% for N > 15, the correlation with GEM10C is considerably lower for N > 36. This indicates that this set is unreliable above this degree. The topographic isostatic reduction potential may be computed either rigorously by integrating the topography and is compensation or by condensing the topography and its compensating masses. In the last case the spherical harmonic coefficients of the isostatic reduction potential are related in a simple linear manner to the spherical harmonic coefficients of the expansion of the topographic heights. An optimal depth of compensation for each degree was determined by requiring the reduced field to be as smooth as possible. Despite between 35 and 15 km were found for N > 20, which are much lower than the values found earlier using another optimal depth principle. G.L.C.

N86-11587# Ceskoslovenska Akademie Ved, Prague. Astronomical Inst.
POLAR MOTION BETWEEN 1900.0 AND 1984.0 AS DETERMINED BY DIFFERENT TECHNIQUES Abstract Only c43
J. Vondrak *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 2 1985 p 143 (For primary document see N86-11568 02-42)
Avail: NTIS HC A09/MF A01

Polar motion between 1900.0 and 1984.0 as determined by classical astrometry and modern techniques (after 1973.0) is studied with stress on periods equal to one year and longer. Carter's hypothesis on the frequency modulation of Chandler wobble is supported; nonlinear relationship between frequency and amplitude can explain the observed phase shifts with rms error + or - 16 deg. Westward secular drift of the mean pole (0.00329''/y in the direction 78.2 deg W) is confirmed, being present also in modern data. The most probable period of Markowitz wobble is found to be 27.5y but its real existence is highly improbable; it is

not present after 1962.0, when more reliable data are available.
G.L.C.

N86-11588# Academia Sinica, Beijing (China). Inst. of Geodesy and Geophysics.
ON THE COMPARISON AND CHOICE BETWEEN THE FORMULAS OF THE EARTH TIDAL CORRECTION IN ASTRONOMICAL TIME AND LATITUDE OBSERVATION **c89**
Jiongyu Xia *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 2 1985 p 144-149 refs (For primary document see N86-11568 02-42)
Avail: NTIS HC A09/MF A01

Three formulas of the earth tidal correction in astronomical time and latitude observations are presented. Two of them were calculated and compared. The main conclusions are as follows: (1) the Wahr formula is more complete than the others in theory and is suitable for calculating the correction of each single wave; (2) the equilibrium tidal formula is fit for calculating the correction of all tidal waves; and (3) the calculation of 11 main tidal waves shows that the earth tidal correction in astronomical time and latitude observation is not the same as the ocean tidal one, in which the several main waves are only needed. It is necessary for the earth tidal correction to calculate as much as possible waves. Therefore the equilibrium tidal formula may more suitable in practice. Author

N86-11589# Academy of Sciences of the Ukrainian SSR, Kiev (USSR). Astronomical Observatory.
ON REDUCING THE EFFECT OF HORIZONTAL DISPLACEMENTS OF THE LITHOSPHERIC PLATES FROM THE OBSERVATIONS CARRIED OUT BY GLOBAL GEODYNAMIC NETWORK (ON EXAMPLE THE GEOSS-REA NETWORK) **c46**
Ya. S. Yatskiv and N. T. Mironov *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 2 1985 p 150-155 refs In RUSSIAN. ENGLISH summary (For primary document see N86-11568 02-42)
Avail: NTIS HC A09/MF A01

On the base of plate tectonic model RM2 the displacements of the lithospheric plates relative to the EURA plate are calculated. This modified relative model is called RM2-REA. Relative changes of angular distances between the stations predicted by means of the RM2-REA model are compared with the observational data (BIH data and Doppler satellite data for the periods 1968-1982 and 1973-1983 respectively. It is shown that the RM2-REA model does not contradict to the observations and could be used for the reduction purpose. G.L.C.

N86-11590# Kiel Univ. (West Germany). Inst. of Geophysics.
ANELASTICITY IN THE EARTH'S MANTLE: IMPLICATIONS FOR THE FREQUENCY DEPENDENCE OF LOVE NUMBERS **c46**
J. Zschau *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 2 1985 p 160 (For primary document see N86-11568 02-42)
Avail: NTIS HC A09/MF A01

Analytical formulas are developed which describe the anelastic and viscous behavior of solids by means of an absorption band as deduced from a Gaussian distribution of relaxation times. These formulas are applied to the Earth's mantle in order to explain post glacial rebound data as well as various observations of anelasticity over a frequency range of more than seven decades including the seismological band as well as free oscillations and the Chandler Wobble. In fitting the parameters of the absorption band to the observations, the effect of composition, structure, phase transitions, pressure and temperature on the anelastic behavior is accounted for by making use of the empirical relationship G'=CI/S sub o were G' is Gibb's free energy of a relaxation process, I the seismic parameter S sub o ambient density and c a constant which is only dependent on the relaxation mechanism itself. This relationship is shown to be well fulfilled for solid state self diffusion in various solids like metals, halides and oxides including minerals important in the mantle. Author

N86-11591# Academy of Sciences, Potsdam (East Germany). Zentralinst. fuer Physik der Erde.
PROCEEDINGS OF THE 5TH INTERNATIONAL SYMPOSIUM GEODESY AND PHYSICS OF THE EARTH, PART 3
1985 169 p refs In ENGLISH and GERMAN Symp. held in Magdeburg, East Germany, 23-29 Sep. 1984 3 Vol.
(Rept-81-Pt-3; ISSN-0514-8790) Avail: NTIS HC A08/MF A01

Studies of recent earth crust movements of local, regional and global importance is reported in this conference. Overall this science is called geodynamics. The determination of the dynamic parameters of crustal blocks in relation to subsurface is discussed. The main source of independent numeric data analyzed are repeated geodetic measurements carried out by means of either surface or space techniques. For individual titles, see N86-11592 through N86-11617.

N86-11592# Research Inst. of Geodesy, Topography and Cartography, Prague (Czechoslovakia).
CRCM AND KAPG ACTIVITY IN RECENT CRUSTAL MOVEMENT STUDIES **c46**
Pavel Vyskocil *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 4-6 refs (For primary document see N86-11591 02-42)
Avail: NTIS HC A08/MF A01

Some results of the work of both organizations in the field of recent crustal movements are discussed. The results of recent crustal movement studies are published in national or international journals and presented at special symposia on recent crustal movements. These studies are briefly discussed. E.R.

N86-11593# Mezoegazdasagi es Elelmezesuegyi Ministerium, Budapest (Hungary). Orszagos Foldugyi es Terkepeszeti Hivatal.
ON THE WORKS AND RESULTS OF INVESTIGATIONS CONCERNING THE RECENT MOVEMENTS IN THE KARPATHO-BALKAN REGION **c46**
I. Joo *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 7-15 refs In GERMAN; ENGLISH summary (For primary document see N86-11591 02-42)
Avail: NTIS HC A08/MF A01

Information is given on the purpose, conditions and method of recent investigations of vertical crustal movements as well as on the results obtained so far. The applied geodetic and oceanographic data is presented together with their reliability and the standard error of derived velocities and absolute height data in tabular form. Derived height value differences between the mean sea levels of the three seas considered (Baltic, Black and Adriatic Seas) are also shown. By now joint adjustment and compilation of national maps of movements have been completed. The derivation of movement velocity gradients and their cartographic presentation is presented. Author

N86-11594# Niedersaechsisches Landesverwaltungsamt, Hanover (West Germany). Abt. Landesvermessung.
NORTH SEA COAST LEVELLING NET: A MODEL CASE FOR THE DETERMINATION OF VERTICAL MOVEMENTS IN WESTERN EUROPE **c46**
Wolfgang Augath and Hans Pelzer (Hannover Univ.) *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 16-25 refs (For primary document see N86-11591 02-42)
Avail: NTIS HC A08/MF A01

In Northern Germany, permanent tide gauge records have been available for investigations since about 1850. As a result of such investigations it was found that in the North Sea the mean sea level (MSL) seems to increase by an amount of approximately 2 mm/year being nearly twice the amount of the eustatic change of the MSL recorded all over the world. This result suggested a coastal subsidence of about 1 mm/year. In order to study this effect in more detail a special precise leveling net (North Sea Coast Leveling Net, NKN) was established after 1910 and observed repeatedly. A tendency toward land subsidence was discovered, the amounts determined lying within their statistical confidence

regions. The Hanover analysis was established for the computation of vertical crustal movements. The computation and results are detailed. Author

N86-11595# Academy of Sciences, Potsdam (East Germany). Zentralinst. fuer Physik der Erde.
SPACE-TIME VARIATING GEOLOGICAL MASSES BY SPACE-TIME VARIATING GEODETIC MEASUREMENTS **c43**
K. Arnold *In its* Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 26-31 refs (For primary document see N86-11591 02-42)
Avail: NTIS HC A08/MF A01

The gravity measurements and the repeated levelings are the space-time variating geodetic measurements which are introduced in the deductions. The plausible hypothesis is presupposed that the recent crustal movement phenomenons which are here to be investigated cover spherical caps of smaller than 1000 kilometer diameter. The other recent crustal movement phenomenons existing at some other distant places exterior of this cap are approximatively supposed to influence not the space-time geodetic measurements within the considered area. The space-time variating geological masses are represented in terms of some point masses. A relation between these geological masses and the space-time geodetic measurements is derived. Author

N86-11596# Academy of Sciences, Potsdam (East Germany). Zentralinst. fuer Physik der Erde.
GEOKINEMATIC MODELS FOR THE GRAVIMETRIC W - E PROFILE OF THE GDR **c46**
W. Conrad, C. Elstner, G. Schwab, W. Schwahn, and S. Thomaschewski *In its* Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 32-43 refs (For primary document see N86-11591 02-42)
Avail: NTIS HC A08/MF A01

The gravimetric W - E profile of the GDR crosses in its western part the Central German - Polish main fault, which forms the transition from the high lying crystalline rocks to the mesozoic-cenozoic sedimentary basin. The net slip of the step fault is about 3 km. The strongest horizontal gradient of gravity in the European region occurs here. Starting from the geological-geophysical situation simple geokinematic models are built up for the interpretation of possible temporal gravity changes, whereby also movements of the Earth's surface were included: relative movements of different blocks and mass redistributions in different geotectonic levels (Upper mantle, Earth's crust and intrasedimentary processes). The deep seated dynamics of the block structure cause in the gravity field a contribution whose extend coincides with a possible subdivision of gravity changes on the W - E profile. The intrasedimentary dynamics may be considered as a noise at the different observation points. Author

N86-11597# Hungarian Academy of Sciences, Sopron. Geodetical and Geophysical Research Inst.
MATHEMATICAL TREATMENT OF VERTICAL MOVEMENTS **c46**
J. Czompo *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 44-50 refs (For primary document see N86-11591 02-42)
Avail: NTIS HC A08/MF A01

The vertical movement is an important geodynamic phenomenon both in regional as well as in local scale. Determination of the kinematical parameters (displacement, velocity and acceleration) is the principal task in the treatment of measured data. Presently, these parameters are usually determined at measured points and some interpolation method is used between these points. The problem is tackled by an analytical method. The observed surface is approximated by a 3D harmonic series in space and in time. An application example is given using DFT to describe the surface motion over a working coal mine. Author

N86-11598# Technische Univ., Dresden (East Germany). Sektion Geodaesie und Kartographie.
GEODIMETER NET FOR THE INVESTIGATION OF HORIZONTAL CRUSTAL DEFORMATIONS [GEODIMETER-NETZ ZUR UNTERSUCHUNG HORIZONTALER KRUSTENDEFORMATIONEN] **c46**
Marion Dost and Guenter Lorenz *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 51-54 refs In GERMAN; ENGLISH summary (For primary document see N86-11591 02-42)
Avail: NTIS HC A08/MF A01

In the German Democratic Republic investigations of horizontal Earth's crustal movements referred until now to the derivation of recent horizontal deformations from multiple observed triangulation nets. They were performed for 20 percent of the territory of the GDR. To obtain more detailed information on the dynamic behavior of the Earth's crust, a special net was established for the first time. It covers by means of a chain structure the most important geological perturbations of the test field Elbe valley zone. Special stress was laid upon the reciprocal surface visibility and the identity with numerous points of older triangulations. The applied GEODIMETER 600 distance meter proved to be successful for these tasks and permits an attempt to receive a new accuracy range. The mean positional error of m sub p = + or - 10 mm obtained for the net part measured until now, makes one optimistic in expecting a considerable more accurate derivation of horizontal deformations and stress. Author

N86-11599# Uppsala Univ. (Sweden). Dept. of Geodesy.
GAUSSIAN AND MEAN CURVATURES OF POSTGLACIAL LAND UPLIFT AS EXPANDED IN SURFACE SPHERICAL HARMONICS, AND THE ORIGIN OF EARTHQUAKES IN FENNOSCANDIA **c46**
Martin Ekman *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 55-70 refs (For primary document see N86-11591 02-42)
Avail: NTIS HC A08/MF A01

Formula for Gaussian and mean curvatures of postglacial land uplift, as expanded in a series of surface spherical harmonics, are derived. These are then applied in investigating if postglacial land uplift is an origin of earthquakes. It is found that the postglacial land uplift of Fennoscandia probably is the origin of the earthquakes along the whole Swedish coast of the Gulf of Bothnia as well as possibly of those in northernmost Sweden, the earthquakes occurring mainly where the Gaussian curvature of land uplift is great enough. No such relationship exists for the earthquakes of southeastern Norway/southwestern Sweden, which then probably do not originate from the land uplift. Author

N86-11600# Academy of Sciences (USSR), Moscow. Inst. of Physics of the Earth.
NEAR-SURFACE DEFORMATIONS AND STRESSES IN THE AREA OF THE TOLBACHIK GREAT FISSURE ERUPTION OF 1975-1976 (KAMCHATKA) FROM GEODETIC DATA **c46**
S. V. Enman *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 71-75 refs (For primary document see N86-11591 02-42)
Avail: NTIS HC A08/MF A01

The analysis of displacements of the points of the triangulation network covering the area of 40x60 km around the region of eruption is presented. Angle and linear measurements were carried out before eruption, during and after eruption. The formulas of mechanics were used to determine the parameters of deformations (values and direction of the principal strain axes, maximal shears, dilatation), the basic regularities in the deformation of the region of eruption were analyzed, and the stress values were calculated with regard to different observation periods. All calculations were made under assumption that the medium is continuous and homogeneous. Author

N86-11601# Mezoegazdasagi es Elelmezesuegyi Ministerium, Budapest (Hungary). Orszagos Foldugyi es Terkepeszeti Hivatal.
METHOD OF JOINT ADJUSTMENT OF HEIGHT DIFFERENCES AND VELOCITIES **c46**
M. Fury, J. Gergely (Foldmeresi Intezet, Budapest), and Zs. Nemeth (Foldmeresi Intezet, Budapest) *In* Academy of Sciences of the

GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 76-78 refs (For primary document see N86-11591 02-42)
Avail: NTIS HC A08/MF A01

The preliminary investigations of Carpatho-Balkan Region's repeated leveling network led to the conclusion that the adjustment should be carried out in a way discussed herein. According to this method the height differences of the second leveling were adjusted jointly with the velocities computed from the first and second levelings. The algorithm of the rigorous adjustment and the weighting system of correlated quantities are presented. The computer program and the network are also discussed. The computation ran in computer HWB 66/20 in FORTRAN by sparse manner. The normal matrix was factorized by means of Gauss elimination. Author

N86-11602# Mezoegazdasagi es Elelmezesuegyi Ministerium, Budapest (Hungary). Orszagos Foldugyi es Terkepeszeti Hivatal.
PRINCIPLE OF THE CONSTRUCTION OF THE LINES OF THE REPEATED LEVELLING FOR THE INVESTIGATION OF THE VERTICAL MOVEMENT IN THE CARPATHO-BALKAN REGION (CBR) c46
M. Fury, J. Gergely (Foldmeresi Intezet, Budapest), and Zs. Nemeth (Foldmeresi Intezet, Budapest) *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 79-83 refs In GERMAN; ENGLISH summary (For primary document see N86-11591 02-42)
Avail: NTIS HC A08/MF A01

Former levelings were carried out with different reliability and protracted for a long time. The final result is doubtlessly influenced by the calculation carried out using the sum of the height differences on the lines led between the knot-points, the mean reliability and the time of measurement of the levelings, as the experimental adjustment showed. This effect can be overcome by carrying out the adjustment of the repeated leveling network with use of leveling sections of same reliability and in a shorter time interval, which extremely increase the volume of the work. Similar results can be obtained by the joint adjustment of the velocity values deduced from both levelings and the height be summed up between the knotpoints without neglecting. It is why the height difference of the second levelling, its reliability and the time of the measurement, as wel as the sum of velocity values deduced for each section and their weight reciprocals were drawn up for each line between the knotpoints in the CBR. Author

N86-11603# Bulgarian Academy of Science, Sofia. Central Lab. for Geodesy.
SOME GEODETIC ASPECTS OF THE PROBLEM OF CHECKING THE PLATE-TECTONIC MODEL OF SEISMICITY IN SOUTH-EASTERN EUROPE c46
N. I. Georgiev, I. N. Totomanov, and C. G. Darakciev *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 84-89 refs (For primary document see N86-11591 02-42)
Avail: NTIS HC A08/MF A01

In the last years, due to the increased accuracy and applicability of the laser range finders of third generation and radio interferometric measuring systems of stationary and mobile types, the satellite geodesy, with its own methods and means, enters in the regional geodynamic investigations. One of the problems is the determination of the recent movements of large Earth's crustal blocks in seismoactive regions, in order to elucidate the mechanism of generation and manifestation of strong earthquakes. Here on the basis of the modern geological-geophysical conception on the mechanism of generating strong earthquakes and volcanic activity in southeastern Europe, some methodical aspects of possible geodetic investigations in the region are discussed. Author

N86-11604# Eidgenoessische Landestopographie, Bern (Switzerland).
RECENT CRUSTAL MOVEMENTS AND GEOPHYSICAL INTERPRETATION OF GEODYNAMIC PROCESSES IN THE ALPINE MOUNTAIN BELT c46
E. Gubler and H.-G. Kahle (Eidgenoessische Technische Hochschule, Zurich) *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 90-97 refs (For primary document see N86-11591 02-42)
Avail: NTIS HC A08/MF A01

It is a well-known fact that the surface phenomena of global plate tectonics are most convincingly seen and felt along the boundaries of the moving lithospheric plates. These boundaries are morphologically expressed as mild-ocean ridges or as subduction zones such as deep sea trenches or Himalayan/Alpine fold belts, the latter of which are the subject of this paper. On a global scale, there are kinematic models giving an idea of what kind of rates can be expected. This is due to the fact that magnetic sea floor spreading anomalies are missing in the Alpine environment. On the other hand, the structure and kinematics of the Apulian microplate are of major interest to Switzerland because its northern boundary seems to be formed by the Alpine chain. In Switzerland there are some 14 special study groups actively working in this field of geodynamics. This paper is restricted to the geodetic and gravity studies. With emphasis on the assumed northern boundary of the Apulian microplate, the kinematics of relative plate movements in the Alpine area were investigated. A simplified tectonic map of this region is shown. B.W.

N86-11605# Karlova Univ., Prague (Czechoslovakia).
DETERMINATION OF CRUSTAL MOVEMENTS IN THE HIGH TATRA MOUNTAINS c46
L. Hradilek *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 98-99 refs (For primary document see N86-11591 02-42)
Avail: NTIS HC A08/MF A01

A method of three-dimensional triangulation is used for determining the crustal movements in the region of the high mountain ridges where the geodetic leveling cannot be performed. The method is based on integrated observations of both horizontal and vertical angles, distances, spirit leveling lines, deflections of the vertical, and on combine processing of all observed data. Network design is discussed. B.W.

N86-11606# Geodetic Inst., Helsinki (Finland).
FINNISH MEASUREMENTS OF THE FENNOSCANDIAN LAND UPLIFT GRAVITY LINES IN FINLAND 1966-1984 c46
Aimo Kiviniemi *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 100-102 refs (For primary document see N86-11591 02-42)
Avail: NTIS HC A08/MF A01

According to the isostatic theory, land uplift reduces gravity. In Finland the connection between land uplift and gravity has been studied with high precision gravity measurements over the past 18 years. The results show that, although there are significant variations in gravity, the variations are not linear with the time but rather periodic ones. Author

N86-11607# Technische Univ., Dresden (East Germany).
STATIONARY HYDROSTATIC PRECISION TILTMETER SYSTEM [STATIONAERES HYDROSTATISCHES PRAEZISIONS-NEIGUNGSMESSSYSTEM] c46
G. Lorenz *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 102-105 refs In GERMAN; ENGLISH summary (For primary document see N86-11591 02-42)
Avail: NTIS HC A09/MF A01

About twenty years ago, a tiltmeter station was established for investigations of recent crustal movements in the most important test area of the GDR. The station is located in a sandrock tunnel system of more than 50 m, the measuring components are orientated in NNW- and ENE-direction. Standard sets of the precision instruments were used with some new constructions and auxiliary equipment. The reliability of the present measuring system is proved if the earth-tides are compared with measuring data. This system is qualified for the investigations of tectonic block tilting. Author

N86-11608# Karlsruhe Univ. (West Germany). Geodetic Inst.
HEIGHT CHANGES AND RECENT CRUSTAL MOVEMENTS IN THE RHENISH MASSIF AND IN THE UPPER RHINE GRABEN RIFT **c46**
H. Maelzer *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 105-112 refs (For primary document see N86-11591 02-42)
Avail: NTIS HC A08/MF A01

Height changes are computed aiming at the investigation of recent crustal movements for the Rhenish Massif and the northern Rhine Graben area. For that purpose results of first order leveling data of the Departments of Ordnance Survey are used. The Rhenish Massif is not lifting like a rigid block. At the present time uplift is restricted to limited areas. In the eastern part tendencies of alternating uplift and subsidence exist, and the western part is characterized by uplift and stability. The northern Rhine Graben area is not only an area of subsidence but also an area of uplift. A trend analysis of recent vertical crustal movements shows tilts in the directions NS and WE. Author

N86-11609# Academy of Sciences (USSR), Moscow. Inst. of Physics of the Earth.
RECENT VERTICAL CRUSTAL MOVEMENTS OF THE CARPATHIAN-BALKAN REGION AND THEIR RELATIONSHIP WITH NEOTECTONIC MOVEMENTS AND GEOPHYSICAL FIELDS **c46**
V. A. Magnitsky, A. F. Grachev, I. V. Kalashnikova, and V. V. Bronguleev *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 113-123 refs (For primary document see N86-11591 02-42)
Avail: NTIS HC A08/MF A01

On the basis of correlation analysis the high degree of inheritance of recent vertical crustal movements from neotectonic movements has been established as for the whole of the Carpathian-Balkan region. Recent vertical crustal movements, neotectonic movements and crustal thickness have a stable reverse correlation with heat flow. This suggests that thermal heating is a probable cause of neotectonic and recent tectonic activity. As a base for comparative analysis the new map of recent crustal movements was used. The map of neotectonic movements in a scale of 1 : 1 000 000, compiled by G. I. Raisner and the international heat flow map of Europe were also used. The boundaries of the studied region and the major structure units are shown. The whole territory was divided into equal quadrants 0 deg 50 x 0 deg 30 and for every quadrant the next average values were determined: recent crustal movements velocity, amplitude of neotectonic movements and crustal thickness. The 290 measurements have been used for calculation of statistics (mean values and standard deviations), correlation coefficients and factors (principal component analysis). B.W.

N86-11610# Academy of Sciences (USSR), Moscow.
ON THE RELATION BETWEEN RECENT CRUSTAL MOVEMENTS, THE SURFACE OF THE BASEMENT COMPLEX AND NEOTECTONIC DISPLACEMENTS OF THE EAST-EUROPEAN PLATFORM **c46**
V. A. Magnitsky, A. F. Grachev, I. V. Kalashnikova, and V. V. Bronguleev *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 124-130 refs (For primary document see N86-11591 02-42)
Avail: NTIS HC A08/MF A01

The problem of the origin of recent crustal movements is one of the most important problems in the field of the Earth's sciences. There exist only a few natural phenomena permitting to obtain the direct information about the processes in the interior of the Earth now in action. Recent crustal movements are one of such phenomena. In the present paper some results are reported of investigations of recent vertical movements of the Earth crust within the western part of East-European platform (to the west from longitude 42 deg E). This region represents an area with slight tectonic activity since Neogen. All the mentioned maps of geophysical and geological fields were treated by the method of trend analysis. As a result schematic maps of the regional component and their residuals were obtained from each field respectively (the radius of averaging is 1000 to 1500 km). B.W.

N86-11611# Technische Univ., Dresden (East Germany).
SIGNIFICANCE TESTS OF RECENT VERTICAL CRUSTAL MOVEMENTS BY CORRELATION FUNCTIONS Abstract Only **c46**
S. Meier *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 131 (For primary document see N86-11591 02-42)
Avail: NTIS HC A08/MF A01

Empirically estimates autocorrelation functions (ACF) of planar, homogeneous isotropic processes of the vertical rate of Earth's recent crustal movements in Central and East Europe are tested by a comparison with ACF's of band filtered leveling errors concerning their geophysical reality. The ACF of the vertical rate in the Pannonian Basin may be coordinated to a real process of movement, the others are explainable, either without restriction or by deducting a linear trend, by error correlations. The data material obviously includes no further predictable movement signals, except the above trend, the partial area Pannonian Basin, and possible local point movements. Therefore, a comprehensive revision of the appropriate maps with isolines of the vertical rate is necessary. Author

N86-11612# Geodetic Inst., Helsinki (Finland).
COMPARISONS OF DIFFERENT OBSERVATION METHODS OF A LACOSTE AND ROMBERG G GRAVIMETER **c46**
Leena Mikkola *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 132-135 refs (For primary document see N86-11591 02-42)
Avail: NTIS HC A08/MF A01

The LaCoste and Romberg gravimeters can be observed by three different methods: optically, with the gravimeters' own galvanometers and with digital voltmeters together with electronic filters. Field measurements and laboratory tests have been made by these methods with LCR G600 in the Finnish Geodetic Institute for comparing the accuracy of the method. Author

N86-11613# Bulgarian Academy of Science, Sofia. Lab. for Geotechnics.
STATISTICAL ANALYSIS AND INTERPRETATION OF EARTH CRUSTAL MOVEMENTS IN NORTHEAST BULGARIA [STATISTISCHE ANALYSE UND INTERPRETATION DER ERDKRUSTENBEWEGUNGEN IN NORDOSTBULGARIEN] **c46**
G. Milev and I. N. Totomanov *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 136-139 refs (For primary document see N86-11591 02-42)
Avail: NTIS HC A08/MF A01

A statistical analysis of the changes in height differences of representative bench marks, measured during two periods of the leveling net in northeast Bulgaria, is made. Considerable differences in exceedings are found which indicate that real changes in the heights of the leveling points exist. By means of velocity maps of the contemporary vertical movements on the same territory, with the aid of a suitable statistical test, it is found that the vertical movements on both sides of the Tvardica fault are insignificant. The methods applied and the results obtained are a contribution to the complex investigations of the contemporary dynamics of the region. Author

N86-11614# Hungarian Academy of Sciences, Sopron. Geodetic and Geophysical Research Inst.
A NEW APPARATUS FOR TESTING BUBBLE VIALS, ELECTRONIC LEVELS AND AUTOMATIC LEVELS **c35**
J. Somogyi, K. Krausz, and Gy. Mentes *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 140-147 refs (For primary document see N86-11591 02-42)
Avail: NTIS HC A08/MF A01

An important task of geodetic research is to increase the accuracy. Several significant results have been achieved in this

field leading to an increase of the role of geodesy in geosciences, e.g., determination of geometric and physical parameters needed for geodynamical investigations. The accuracy of astrogeodetic measurements and high precision leveling must be also increased. A part of this task is a more correct qualification of different levels and leveling instruments. For this purpose a new level trier/tiltmeter has been constructed. The main aspects of the construction of this new apparatus are the following: (1) more accurate measurement of the tilt angle; (2) more accurate measurement of the bubble movement; (3) electronic sensing and digital display of the measured values; (4) one line connection to the computer; and (5) decrease of the effect of outer disturbances during measurements and comfortable handling. B.W.

N86-11615# Bulgarian Academy of Science, Sofia. Central Lab. for Geodesy.
RELATION BETWEEN EARTHQUAKE FOCAL INTENSITY AND RECENT VERTICAL EARTH'S CRUSTAL MOVEMENTS IN THE RILA-RHODOPE SEISMIC REGION **c46**
Ivan N. Totomanov *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 148-155 refs (For primary document see N86-11591 02-42)
Avail: NTIS HC A08/MF A01

The stable statistical relation is studied between the maximum magnitude Y of expected earthquakes with foci in the Earth's crust and the vertical velocity X of recent crustal movements, in the mountainous region of southwestern Bulgaria characterized by a particularly high seismic and tectonic activity. The two dimensional random variate (X,Y) is presented by its sample (Xk, Yk), k = 1, 2,..., 60 composed by appropriate smoothed estimates according to data of the most recent investigations. The sampling (joint and respective marginal) distributions of (X, Y) are determined and examined. Statistical hypotheses are tested and the respective recent geokinematic and tectonic predestination of the seismic activity in the Rila-Rhodope seismic region is argued in terms of the best fit, to the empirical data, regression polynomial of Y with respect to X. A comparison is made between results obtained on the region under examination and corresponding data of earlier studies. Author

N86-11616# Research Inst. of Geodesy, Topography and Cartography, Prague (Czechoslovakia).
DYNAMICS OF THE BOHEMIAN MASSIF **c46**
Pavel Vyskocil *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 156-159 refs (For primary document see N86-11591 02-42)
Avail: NTIS HC A08/MF A01

The Bohemian Massif is a solid block surrounded by the Alps and Carpathians from south and south-east respectively. The main idea of the presented paper is the controlling role of the Alps at the dynamics of the Bohemian Massif. The initial assumption is discussed with respect to the results of new repeated levelings, local horizontal measurements as well as to the disturbance lines determined from satellite images. In addition the results of local horizontal and vertical remeasurements performed at the test area of Lisov, southern Bohemia, are taken into consideration. The discussion of mentioned data leads to conclusions on the possible role of the Alpine pressure as a driving force in dynamics of the Bohemian Massif. Author

N86-11617# Academy of Sciences, Potsdam (East Germany). Zentralinst. fuer Physik der Erde.
AN OPTIMUM USE OF SEA-LEVEL RECORDINGS **c46**
H. Weise *In its* Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 160-168 refs (For primary document see N86-11591 02-42)
Avail: NTIS HC A08/MF A01

A reference niveau is necessary for proof of vertical recent crustal movements. The undisturbed surface of the sea is a suitable reference niveau. It is deduced from continuous sea level recordings at the adjacent coasts of most countries. For a significant proof it is necessary to presume: (1) modern measurement techniques, with adequate resolution in time and area; (2) homogeneous data collections for a long time range; and (3) careful analysis methods for treatment of measuring data. Propositions for working modus are offered in connection with this geoscientific assertion. Author

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography.*

N86-11618*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PROCEEDINGS OF THE AIRBORNE IMAGING SPECTROMETER DATA ANALYSIS WORKSHOP
Gregg Vane, ed. and Alexander F. H. Goetz, ed. 15 Jun. 1985 180 p refs Workshop held in Pasadena, Calif., 8-10 Apr. 1985 Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Contract NAS7-918)
(E86-10001; NASA-CR-176210; JPL-Pub-85-41; NAS 1.26:176210) Avail: NTIS HC A09/MF A01 CSCL 05B

The Airborne Imaging Spectrometer (AIS) Data Analysis Workshop was held at the Jet Propulsion Laboratory on April 8 to 10, 1985. It was attended by 92 people who heard reports on 30 investigations currently under way using AIS data that have been collected over the past two years. Written summaries of 27 of the presentations are in these Proceedings. Many of the results presented at the Workshop are preliminary because most investigators have been working with this fundamentally new type of data for only a relatively short time. Nevertheless, several conclusions can be drawn from the Workshop presentations concerning the value of imaging spectrometry to Earth remote sensing. First, work with AIS has shown that direct identification of minerals through high spectral resolution imaging is a reality for a wide range of materials and geological settings. Second, there are strong indications that high spectral resolution remote sensing will enhance the ability to map vegetation species. There are also good indications that imaging spectrometry will be useful for biochemical studies of vegetation. Finally, there are a number of new data analysis techniques under development which should lead to more efficient and complete information extraction from imaging spectrometer data. The results of the Workshop indicate that as experience is gained with this new class of data, and as new analysis methodologies are developed and applied, the value of imaging spectrometry should increase. For individual titles, see N86-11619 through N86-11644.

N86-11619*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
MINERALOGICAL MAPPING IN THE CUPRITE MINING DISTRICT, NEVADA **c46**
Alexander F. H. Goetz and Vinay Srivastava *In its* Proc. of the Airborne Imaging Spectrometer Data Anal. Workshop 15 Jun. 1985 p 22-31 refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS (For primary document see N86-11618 02-43)
Avail: NTIS HC A09/MF A01 CSCL 08G

The airborne imaging spectrometer (AIS) has provided for the first time, the possibility to map mineralogical constituents in the Earth's surface and thus has enormously increased the value of remote-sensing data as a tool in the solution of geologic problems. The question addressed with AIS at Cuprite was how well could the mineral components at the surface of a hydrothermal alteration zone be detected, identified and mapped? The question was answered positively and is discussed. A relatively rare mineral,

buddingtonie, that could not have been detected by conventional means, was discovered and mapped by the use of AIS. Author

N86-11620*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
REMOTE STRATIGRAPHIC ANALYSIS: COMBINED TM AND AIS RESULTS IN THE WIND RIVER/BIGHORN BASIN AREA, WYOMING
H. R. Lang, E. D. Paylor, and S. Adams *In its* Proc. of the Airborne Imaging Spectrometer Data Anal. Workshop 15 Jun. 1985 p 32-34 ref ERTS (For primary document see N86-11618 02-43)
Avail: NTIS HC A09/MF A01 CSCL 08B

An in-progress study demonstrates the utility of airborne imaging spectrometer (AIS) data for unraveling the stratigraphic evolution of a North American, western interior foreland basin. AIS data are used to determine the stratigraphic distribution of mineralogical facies that are diagnostic of specific depositional environments. After wavelength and amplitude calibration using natural ground targets with known spectral characteristics, AIS data identify calcite, dolomite, gypsum and montmorillonite-bearing strata in the Permian-Cretaceous sequence. Combined AIS and TM results illustrate the feasibility of spectral stratigraphy, remote analysis of stratigraphic sequences. Author

N86-11621*# Stanford Univ., Calif. Dept. of Applied Earth Sciences.
FIELD UTILIZATION AND ANALYSIS OF AIS 128-CHANNEL IMAGERY USING MICROCOMPUTERS: APPLICATION TO YERINGTON, NEVADA FIELD AREA
R. J. P. Lyon and Kai Lanz *In* JPL Proc. of the Airborne Imaging Spectrometer Data Anal. Workshop 15 Jun. 1985 p 35-40 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS (For primary document see N86-11618 02-43)
Avail: NTIS HC A09/MF A01 CSCL 05B

Geologists in exploration need to be able to determine the mineral composition of a given outcrop, and then proceed to another in order to carry out the process of geologic mapping. Since April 1984 researchers have been developing a portable microcomputer-based imaging system (with a grey-scale of 16 shades of amber), which were demonstrated during the November 1984 GSA field trip in the field at Yerington, NV. A color-version of the same technology was recently demonstrated. The portable computer selected is a COLBY 10-Megabyte, hard disk-equipped repackaged-IBM/XT, which operates on either 110/220 VAC or on 12VDC from the cigarette lighter in a field vehicle. A COMPAQ PLUS or an IBM Portable will also work on modified software. The underlying concept is that the atmospheric transmission and surface albedo/slope terms are multiplicative, relating the spectral irradiance to the spectral color of the surface materials. Thus, the spectral color of a pixel remains after averaged log-albedo and log-irradiance have been estimated. All these steps can be carried out on the COLBY microcomputer, using 80 image lines of the 128-channel, 12-bit imagery. Results are shown for such an 80-line segment, showing the identification of an O-H bearing mineral group (of slightly varying specific characters) on the flight line. Author

N86-11622*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PRELIMINARY ANALYSIS OF AIS SPECTRAL DATA ACQUIRED FROM SEMI-ARID SHRUB COMMUNITIES IN THE OWENS VALLEY, CALIFORNIA
Susan L. Ustin (California Univ., Berkeley) and Barrett N. Rock *In its* Proc. of the Airborne Imaging Spectrometer Data Anal. Workshop 15 Jun. 1985 p 41-45 refs ERTS (For primary document see N86-11618 02-43)
Avail: NTIS HC A09/MF A01 CSCL 05B

Spectral characteristics of semic-arid plant communities using 128 channel airborne imaging spectrometer (AIS) data acquired on October 30, 1984. Both field and AIS spectra of vegetation were relatively featureless and differed from substrate spectra primarily in albedo. Unvegetated sand dunes were examined to assess spectral variation resulting from topographic irregularity. Although shrub cover as low as 10% could be detected on relatively flat surfaces, such differences were obscured in more heterogeneous terrain. Sagebrush-covered fans which had been scarred by fire were studied to determine the effect of changes in plant density on reflectance. Despite noise in the atmospherically corrected spectra, these provide better resolution of differences in plant density than spectra which are solar-corrected only. A high negative correlation was found between reflectance and plant cover in areas which had uniform substrates and vegetation types. A lower correlation was found where vegetation and substrates were more diverse. Author

N86-11623*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
AIS SPECTRA FOR STRESSED AND UNSTRESSED PLANT COMMUNITIES IN THE CAROLINA SLATE BELT
Diane E. Wickland *In its* Proc. of the Airborne Imaging Spectrometer Data Anal. Workshop 15 Jun. 1985 p 46-50 refs ERTS (For primary document see N86-11618 02-43)
Avail: NTIS HC A09/MF A01 CSCL 05B

Airborne imaging spectrometer (AIS) data were collected over a number of derelict heavy metal mine sites in the Carolina slate belt of North Carolina. A 32 channel (1156 to 1456 nm) data set was acquired in October, 1983 at the time of peak fall foliage display, and a 128 channel (1220 to 2420) data set was acquired near the end of the spring leaf flush in May, 1984. Spectral curves were extracted from the AIS data for differing ground cover types (e.g., pine forests, mixed deciduous forests, mine sites, and pastures). Variation in the width of an absorption feature located at approximately 1190 nm has been related to differences in forest type. Small differences in the location and shape of features in the near infrared plateau (1156 to 1300 nm) and the region 2000 to 2420 nm have yet to be evaluated. Because these variations were subtle, and because atmospheric effects were apparent in the data, high priority must be assigned to devising a means of removing atmospheric effects from AIS spectra. Author

N86-11624*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SPECTRAL CHARACTERIZATION OF SUSPECTED ACID DEPOSITION DAMAGE IN RED SPRUCE (PICEA RUBENS) STANDS FROM VERMONT c45
James E. Vogelmann and Barrett N. Rock *In its* Proc. of the Airborne Imaging Spectrometer Data Anal. Workshop 15 Jun. 1985 p 51-55 refs ERTS (For primary document see N86-11618 02-43)
Avail: NTIS HC A09/MF A01 CSCL 13B

In an attempt to demonstrate the utility of remote sensing systems to monitor sites of suspected acid rain deposition damage, intensive field activities, coupled with aircraft overflights, were centered on red spruce stands in Vermont during August and September of 1984. Remote sensing data were acquired using the Airborne Imaging Spectrometer, Thematic Mapper Simulator, Barnes Model 12 to 1000 Modular Multiband Radiometer and Spectron Engineering Spectrometer (the former two flown on the NASA C-130; the latter two on A Bell UH-1B Iroquois Helicopter). Field spectral data were acquired during the week of the August overflights using a high spectral resolution spectrometer and two broad-band radiometers. Preliminary analyses of these data indicate a number of spectral differences in vegetation between high and low damage sites. Some of these differences are subtle, and are observable only with high spectral resolution sensors; others are less subtle and are observable using broad-band sensors. Author

N86-11625*# Nevada Univ., Reno. School of Mines.
A FIRST LOOK AT AIRBORNE IMAGING SPECTROMETER (AIS) DATA IN AN AREA OF ALTERED VOLCANIC ROCKS AND CARBONATE FORMATIONS, HOT CREEK RANGE, SOUTH CENTRAL NEVADA
Sandra C. Feldman, James V. Taranik, and David A. Mouat (Stanford Univ.) *In* JPL Proc. of the Airborne Imaging Spectrometer

Data Anal. Workshop 15 Jun. 1985 p 56-61 refs ERTS (For primary document see N86-11618 02-43)
Avail: NTIS HC A09/MF A01 CSCL 08G

Three flight lines of Airborne Imaging Spectrometer (AIS) data were collected in 128 bands between 1.2 and 2.4 microns in the Hot Creek Range, Nevada on July 25, 1984. The flight lines are underlain by hydrothermally altered and unaltered Paleozoic carbonates and Tertiary rhyolitic to latitic volcanics in the Tybo mining district. The original project objectives were to discriminate carbonate rocks from other rock types, to distinguish limestone from dolomite, and to discriminate carbonate units from each other using AIS imagery. Because of high cloud cover over the prime carbonate flight line and because of the acquisition of another flight line in altered and unaltered volcanics, the study has been extended to the discrimination of alteration products. In an area of altered and unaltered rhyolites and latites in Red Rock Canyon, altered and unaltered rock could be discriminated from each other using spectral features in the 1.16 to 2.34 micron range. The altered spectral signatures resembled montmorillonite and kaolinite. Field samples were gathered and the presence of montmorillonite was confirmed by X-ray analysis. Author

N86-11626*# Washington Univ., Seattle. Dept. of Geological Sciences.
INTERPRETATION OF AIS IMAGES OF CUPRITE, NEVADA USING CONSTRAINTS OF SPECTRAL MIXTURES
Milton O. Smith and John B. Adams *In* JPL Proc. of the Airborne Imaging Spectrometer Data Anal. Workshop 15 Jun. 1985 p 62-67 refs ERTS (For primary document see N86-11618 02-43)
Avail: NTIS HC A09/MF A01 CSCL 05B

A technique is outlined that tests the hypothesis Airborne Imaging Spectrometer (AIS) image spectra are produced by mixtures of surface materials. This technique allows separation of AIS images into concentration images of spectral endmembers (e.g., surface materials causing spectral variation). Using a spectral reference library it was possible to uniquely identify these spectral endmembers with respect to the reference library and to calibrate the AIS images. Author

N86-11627*# Nebraska Univ., Lincoln.
EVALUATION OF AIS DATA FOR AGRONOMIC AND RANGELAND VEGETATION: PRELIMINARY RESULTS FOR AUGUST 1984 FLIGHT OVER NEBRASKA SANDHILLS AGRICULTURAL LABORATORY
Blaine L. Blad, Patrick J. Starks, Cynthia Hays, and Bronson R. Gardner (Standard Oil, Cleveland, Ohio) *In* JPL Proc. of the Airborne Imaging Spectrometer Data Anal. Workshop 15 Jun. 1985 p 68-70 ref ERTS (For primary document see N86-11618 02-43)
Avail: NTIS HC A09/MF A01 CSCL 05B

Since 1978 scientists from the Center for Agricultural Meteorology and Climatology at the University of Nebraska have been conducting research at the Sandhills Agricultural Laboratory on the effects of water stress on crop growth, development and yield using remote sensing techniques. We have been working to develop techniques, both remote and ground-based, to monitor water stress, phenological development, leaf area, phytomass production and grain yields of corn, soybeans and sorghum. Because of the sandy soils and relatively low rainfall at the site it is an excellent location to study water stress without the necessity of installing expensive rainout shelters. The primary objectives of research with the airborne imaging spectrometer (AIS) data collected during an August 1984 flight over the Sandhills Agricultural Laboratory are to evaluate the potential of using AIS to: (1) discriminate crop type; (2) to detect subtle architectural differences that exist among different cultivars or hybrids of agronomic crops; (3) to detect and quantify, if possible, the level of water stress imposed on the crops; and (4) to evaluate leaf area and biomass differences for different crops. Author

N86-11628*# Standard Oil Co., Cleveland, Ohio.
SITE DESCRIPTION FOR THE UNIVERSITY OF NEBRASKA'S SANDHILLS AGRICULTURAL LABORATORY
B. R. Gardner and Blaine L. Blad (Nebraska Univ., Lincoln) *In* JPL Proc. of the Airborne Imaging Spectrometer Data Anal. Workshop 15 Jun. 1985 p 71-73 ERTS (For primary document see N86-11618 02-43)
Avail: NTIS HC A09/MF A01 CSCL 08B

The Sandhills Agricultural Laboratory is operated by the University of Nebraska. The laboratory is located in the south-central part of the Nebraska Sandhills near Tryon, Nebraska (41 deg. 37' N; 100 deg. 50' W). The laboratory is surrounded on the west and south by native rangeland vegetation, on the south by a large field of corn irrigated by a center pivot, and on the east by wheat stubble. This site is appropriate for moisture stress studies since rainfall is almost always inadequate to meet evaporative demands of agricultural crops during most of the growing season and the sandy soils (Valentine fine sand) at the site do not store large quantities of water. Various levels of water stress are achieved through irrigation from solid set sprinklers. Author

N86-11629*# Nebraska Univ., Lincoln. Remote Sensing Center.
PRELIMINARY EVALUATION OF AIS SPECTRA ALONG A TOPOGRAPHIC/MOISTURE GRADIENT IN THE NEBRASKA SANDHILLS
Donald C. Runquist *In* JPL Proc. of the Airborne Imaging Spectrometer Data Anal. Workshop 15 Jun. 1985 p 74-78 refs ERTS (For primary document see N86-11618 02-43)
Avail: NTIS HC A09/MF A01 CSCL 08B

Six spectral plots, each summarizing single-pixel reflectance for 128 channels of Airborne Imaging Spectrometer (AIS) data, were examined. The six sample pixels were located along a topographic/moisture gradient from lake surface to dune top in the Nebraska Sandhills. AIS spectra for various moisture regimes/vegetative zones appear quite logical, with a general positive relationship between increasing elevation (i.e., decreasing access of plant roots to water) and increasing reflectance in the spectral regions diagnostic of leaf-water content (i.e., bands centered on 1.65 and 2.20 microns). Author

N86-11630*# Nebraska Univ., Lincoln. Dept. of Agronomy.
THE USE OF AIS DATA FOR IDENTIFYING AND MAPPING CALCAREOUS SOILS IN WESTERN NEBRASKA
Scott A. Samson *In* JPL Proc. of the Airborne Imaging Spectrometer Data Anal. Workshop 15 Jun. 1985 p 79-83 ERTS (For primary document see N86-11618 02-43)
Avail: NTIS HC A09/MF A01 CSCL 05B

The identification of calcareous soils, through unique spectral responses of the vegetation to the chemical nature of calcareous soils, can improve the accuracy of delineating the boundaries of soil mapping units over conventional field techniques. The objective of this experiment is to evaluate the use of the Airborne Imaging Spectrometer (AIS) in the identification and delineation of calcareous soils in the western Sandhills of Nebraska. Based upon statistical differences found in separating the spectral curves below 1.3 microns, calcareous and non-calcareous soils may be identified by differences in species of vegetation. Additional work is needed to identify biogeochemical differences between the two soils. Author

N86-11631*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
CALIBRATION OF AIS DATA USING GROUND-BASED SPECTRAL REFLECTANCE MEASUREMENTS
James E. Conel *In its* Proc. of the Airborne Imaging Spectrometer Data Anal. Workshop 15 Jun. 1985 p 84-85 ERTS (For primary document see N86-11618 02-43)
Avail: NTIS HC A09/MF A01 CSCL 05B

Present methods of correcting airborne imaging spectrometer (AIS) data for instrumental and atmospheric effects include the flat- or curved-field correction and a deviation-from-the-average adjustment performed on a line-by-line basis throughout the image. Both methods eliminate the atmospheric absorptions, but remove the possibility of studying the atmosphere for its own sake, or of

using the atmospheric information present as a possible basis for theoretical modeling. The method discussed here relies on use of ground-based measurements of the surface spectral reflectance in comparison with scanner data to fix in a least-squares sense parameters in a simplified model of the atmosphere on a wavelength-by-wavelength basis. The model parameters (for optically thin conditions) are interpretable in terms of optical depth and scattering phase function, and thus, in principle, provide an approximate description of the atmosphere as a homogeneous body intervening between the sensor and the ground. Author

N86-11632*# Earth Satellite Corp., Chevy Chase, Md.
ANALYSIS OF AIS DATA OF THE RECLUSE OIL FIELD, RECLUSE, WYOMING
Jon D. Dykstra and Donald B. Segal *In* JPL Proc. of the Airborne Imaging Spectrometer Data Anal. Workshop 15 Jun. 1985 p 86-91 Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS (For primary document see N86-11618 02-43)
Avail: NTIS HC A09/MF A01 CSCL 05B

Airborne Imaging Spectrometer (AIS) data were flown over the Recluse, Wyoming oil field on September 9, 1984. Processing software was developed at Earth Satellite Corporation (EarthSat) for interactive analysis of the AIS data. EarthSat's AIS processing capabilities include destriping, solar irradiance corrections, residual calculations, geometric resampling, equal energy normalization, interactive spectral classifications and a variety of compressive algorithms to reduce the data to 8-bit format with a minimum of information loss. The in-house photolab facilities of EarthSat can routinely produce high-quality color renditions of the enhanced AIS data. A total of 80 lithologic samples were collected under the AIS flight lines. Correlation (within the atmospheric windows) between the laboratory and the AIS spectra of sample sites was generally poor. Reasonable correlation was only possible in large, freshly plowed fields. Mixed pixels and contrast between the natural and sample's surfaces were believed responsible for the poor correlation. Finally, a drift of approximately three channels was observed in the diffraction grating position within the 1.8 to 2.1 micron quadrant. Author

N86-11633*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
HIGH RESOLUTION SPECTROMETRY OF LEAF AND CANOPY CHEMISTRY FOR BIOCHEMICAL CYCLING
Michael A. Spanner (Technicolor Government Services, Moffett Field, Calif.), David L. Peterson, William Acevedo (Technicolor Government Services, Moffett Field, Calif.), and Pamela Matson *In* JPL Proc. of the Airborne Imaging Spectrometer Data Anal. Workshop 15 Jun. 1985 p 92-99 refs ERTS (For primary document see N86-11618 02-43)
Avail: NTIS HC A09/MF A01 CSCL 05B

High-resolution laboratory spectrophotometer and Airborne Imaging Spectrometer (AIS) data were used to analyze forest leaf and canopy chemistry. Fundamental stretching frequencies of organic bonds in the visible, near infrared and short-wave infrared are indicative of concentrations and total content of nitrogen, phosphorous, starch and sugar. Laboratory spectrophotometer measurements showed very strong negative correlations with nitrogen (measured using wet chemistry) in the visible wavelengths. Strong correlations with green wet canopy weight in the atmospheric water absorption windows were observed in the AIS data. A fairly strong negative correlation between the AIS data at 1500 nm and total nitrogen and nitrogen concentration was evident. This relationship corresponds very closely to protein absorption features near 1500 nm. Author

N86-11634# Wisconsin Univ., Madison. Dept. of Forestry.
FOREST CANOPY CHEMISTRY FROM BLACKHAWK ISLAND, WISCONSIN
James H. Fownes and John D. Aber *In* JPL Proc. of the Airborne Imaging Spectrometer Data Anal. Workshop 15 Jun. 1985 p 100-104 ERTS (For primary document see N86-11618 02-43)
Avail: NTIS HC A09/MF A01 CSCL 02F

This ongoing project attempts to develop process-oriented models of forest productivity, which are driven by canopy spectral data. Concurrent with Airborne Imaging Spectrometer (AIS) flyover, a series of mixed-species hardwood forests were sampled for leaf morphological characteristics; total leaf mass, area, and vertical distribution; and overall average canopy nitrogen and lignin. Within a canopy, leaf specific weight (dry weight per unit area) varied significantly with height and between species. Species are separated ecologically by percent nitrogen and lignin. Mean total canopy percent lignin correlates well with previously published field estimates of soil nitrogen availability and total annual net primary productivity, which augurs well for the model, subject to identification of unambiguous spectral signals. Author

N86-11635*# Brown Univ., Providence, R. I. Dept. of Geological Sciences.
SPECTROSCOPY OF MOSES ROCK KIMBERLITE DIATREME c46
Carle M. Pieters and John F. Mustard *In* JPL Proc. of the Airborne Imaging Spectrometer Data Anal. Workshop 15 Jun. 1985 p 106-110 refs ERTS (For primary document see N86-11618 02-43)
Avail: NTIS HC A09/MF A01 CSCL 08G

Three types of remote sensing data (Airborne Imaging Spectroscopy (AIS), NS001, Zeiss IR-photographs) were obtained for the Moses Rock kimberlite dike in southern Utah. The goal is to identify and characterize the mantle derived mafic component in such volcanic features. The Zeiss and NS001 images provide information on the regional setting and allow units of the dike to be distinguished from surrounding material. A potential unmapped satellite dike was identified. The AIS data provide characterizing information of the surface composition of the dike. Serpentized olivine-bearing soils are (tentatively) identified from the AIS spectra for a few areas within the dike. Author

N86-11636*# Commonwealth Scientific and Industrial Research Organization, Sydney (Australia). Div. of Mineral Physics.
ANALYSIS OF AIRCRAFT SPECTROMETER DATA WITH LOGARITHMIC RESIDUALS
A. A. Green and M. D. Craig *In* JPL Proc. of the Airborne Imaging Spectrometer Data Anal. Workshop 15 Jun. 1985 p 111-119 refs ERTS (For primary document see N86-11618 02-43)
Avail: NTIS HC A09/MF A01 CSCL 05B

Spectra from airborne systems must be analyzed in terms of their mineral-related absorption features. Methods for removing backgrounds and extracting these features one at a time from reflectance spectra are discussed. Methods for converting radiance spectra into a form similar to reflectance spectra so that the feature extraction procedures can be implemented on aircraft spectrometer data are also discussed. Author

N86-11637*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMPARISON OF AIS VERSUS TMS DATA COLLECTED OVER THE VIRGINIA PIEDMONT
R. Bell and C. S. Evans (Maryland Univ.) *In* JPL Proc. of the Airborne Imaging Spectrometer Data Anal. Workshop 15 Jun. 1985 p 120-122 refs ERTS (For primary document see N86-11618 02-43)
Avail: NTIS HC A09/MF A01 CSCL 05B

The Airborne Imaging Spectrometer (AIS, NS001 Thematic Mapper Simlulator (TMS), and Zeiss camera collected remotely sensed data simultaneously on October 27, 1983, at an altitude of 6860 meters (22,500 feet). AIS data were collected in 32 channels covering 1200 to 1500 nm. A simple atmospheric correction was applied to the AIS data, after which spectra for four cover types were plotted. Spectra for these ground cover classes showed a telescoping effect for the wavelength endpoints. Principal components were extracted from the shortwave region of the AIS (1200 to 1280 nm), full spectrum AIS (1200 to 1500 nm) and TMS (450 to 12,500 nm) to create three separate three-component color image composites. A comparison of the TMS

band 5 (1000 to 1300 nm) to the six principal components from the shortwave AIS region (1200 to 1280 nm) showed improved visual discrimination of ground cover types. Contrast of color image composites created from principal components showed the AIS composites to exhibit a clearer demarcation between certain ground cover types but subtle differences within other regions of the imagery were not as readily seen. Author

N86-11638*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A PRELIMINARY INVESTIGATION OF SYSTEMATIC NOISE IN DATA ACQUIRED WITH THE AIRBORNE IMAGING SPECTROMETER
Edward Masuoka *In* JPL Proc. of the Airborne Imaging Spectrometer Data Anal. Workshop 15 Jun. 1985 p 123-128 Original contains imagery. Original photography may be purchased from the EROS Data Ceter, Sioux Falls, S.D. 57198 ERTS (For primary document see N86-11618 02-43)
Avail: NTIS HC A09/MF A01 CSCL 05B

Systematic noise is present in Airborne imaging Spectrometer (AIS) data collected on October 26, 1983 and May 5, 1984 in grating position 0 (1.2 to 1.5 microns). In the October data set the noise occurs as 135 scan lines of low DN's every 270 scan lines. The noise is particularly bad in bands nine through thirty, restricting effective analysis to at best ten of the 32 bands. In the May data the regions of severe noise have been eliminated, but systematic noise is present with three frequencies (3, 106 and 200 scan lines) in all thirty two bands. The periodic nature of the noise in both data sets suggests that it could be removed as part of routine processing. This is necessary before classification routines or statistical analyses are used with these data. Author

N86-11639*# Delaware Univ., Newark. Coll. of Marine Studies.
DISCRIMINATION OF COASTAL VEGETATION AND BIOMASS: USING AIS DATA
Michael F. Gross and V. Klemas *In* JPL Proc. of the Airborne Imaging Spectrometer Data Anal. Workshop 15 Jun. 1985 p 129-133 refs ERTS (For primary document see N86-11618 02-43)
Avail: NTIS HC A09/MF A01 CSCL 02C

The Airborne Imaging Spectrometer (AIS) was flown over a coastal wetlands region near Lewes, Delaware, adjacent to the Delaware Bay on 16 August 1984. Using the AIS data, it was possible to discriminate between four different types of wetland vegetation canopies: (1) trees; (2) broadleaf herbaceous plants (e.g., Acnida cannabina, Hisbiscus moscheutos); (3) the low marsh grass Spartina alterniflora; and (4) the high marsh grasses Distichlis spicata and Spartina patens. The single most useful region of the spectrum was that between 1.40 and 1.90 microns, where slopes of portions of the radiance curve and ratios of radiance at particular wavelengths were significantly different for the four canopy types. The ratio between the highest digital number in the 1.40 to 1.90 microns and .84 to .94 microns regions and a similar ratio between the peaks in radiance in the 1.12 to 1.40 microns and .84 to .94 microns spectral regions were also very effective at discriminating between vegetation types. Differences in radiance values at various wavelengths between samples of the same vegetation type could potentially be used to estimate biomass. Author

N86-11640*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AIS INVESTIGATION OF AGRICULTURAL MONOCULTURES
Byron L. Wood (Technicolor Government Services, Inc., Moffett Field, Calif.) and Robert C. Wrigley *In* JPL Proc. of the Airborne Imaging Spectrometer Data Anal. Workshop 15 Jun. 1985 p 134-140 ERTS (For primary document see N86-11618 02-43)
Avail: NTIS HC A09/MF A01 CSCL 02C

Airborne Imaging Spectrometer (AIS) data were acquired over an agricultural area in eastern San Joaquin County, California in July, 1984. Cover type information was subsequently collected for all fields along this flight line. The lack of detailed ground data on individual fields, however, limited AIS data analysis to a qualitative comparison of the spectral reflectance curves for a total of nine cover types. Based on this analysis, it appears that cover types with a positive slope in the 1550 to 1700 nm region have a higher spectral response in the 1200 to 1300 nm region compared to those cover types with a negative slope in the 1550 to 1700 nm region. Within cover type, spectral variability was also found to be greater than that between cover types. Given the lack of additional field data, the reason for these differences is a matter of speculation. Author

N86-11641*# California Univ., Santa Barbara. Remote Sensing Research Unit.
APPLICATION OF AIS TECHNOLOGY TO FOREST MAPPING
Stephen R. Yool and Jeffrey L. Star *In* JPL Proc. of the Airborne Imaging Spectrometer Data Anal. Workshop 15 Jun. 1985 p 141-145 refs ERTS (For primary document see N86-11618 02-43)
Avail: NTIS HC A09/MF A01 CSCL 02F

Concerns about environmental effects of large scale deforestation have prompted efforts to map forests over large areas using various remote sensing data and image processing techniques. Basic research on the spectral characteristics of forest vegetation are required to form a basis for development of new techniques, and for image interpretation. Examination of LANDSAT data and image processing algorithms over a portion of boreal forest have demonstrated the complexity of relations between the various expressions of forest canopies, environmental variability, and the relative capacities of different image processing algorithms to achieve high classification accuracies under these conditions. Airborne Imaging Spectrometer (AIS) data may in part provide the means to interpret the responses of standard data and techniques to the vegetation based on its relatively high spectral resolution. Author

N86-11642*# Stanford Univ., Calif. Applied Earth Sciences.
A COMPARISON OF AIS DATA WITH OTHER AIRCRAFT AND GROUND DATA FOR THE GEOBOTANICAL DISCRIMINATION OF ROCK TYPES IN SOUTHWEST OREGON
David A. Mouat *In* JPL Proc. of the Airborne Imaging Spectrometer Data Anal. Workshop 15 Jun. 1985 p 146-151 refs ERTS (For primary document see N86-11618 02-43)
Avail: NTIS HC A09/MF A01 CSCL 08G

The use of remote sensing techniques for the geobotanical discrimination of rock types is predicated upon a number of factors. These include an understanding of vegetation response to environmental (especially geochemical) conditions, the establishment of correlations between those vegetation factors and environmental factors, and the use of appropriate remote sensing techniques to discriminate the vegetation. Author

N86-11643*# Michigan Univ., Ann Arbor. School of Natural Resources.
FOREST SPECIES IDENTIFICATION WITH HIGH SPECTRAL RESOLUTION DATA
Charles E. Olson, Jr. and Zhiliang Zhu (Nanjing Inst. of Forestry, China) *In* JPL Proc. of the Airborne Imaging Spectrometer Data Anal. Workshop 15 Jun. 1985 p 152-157 refs ERTS (For primary document see N86-11618 02-43)
Avail: NTIS HC A09/MF A01 CSCL 02F

Data collected over the Sleeping Bear Sand Dunes Test Site and the Saginaw Forest Test Site (Michigan) with the JPL Airborne Imaging Spectrometer and the Collins' Airborne Spectroradiometer are being used for forest species identification. The linear discriminant function has provided higher identification accuracies than have principal components analyses. Highest identification accuracies are obtained in the 450 to 520 nm spectral region. Spectral bands near 1,300, 1,685 and 2,220 nm appear to be important, also. Author

N86-11644*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
URBAN, FOREST, AND AGRICULTURAL AIS DATA: FINE SPECTRAL STRUCTURE

V. C. Vanderbilt *In* JPL Proc. of the Airborne Imaging Spectrometer Data Anal. Workshop 15 Jun. 1985 p 158-165 ERTS (For primary document see N86-11618 02-43)
Avail: NTIS HC A09/MF A01 CSCL 05B

Spectra acquired by the Airborne Imaging Spectrometer (AIS) near Lafayette, IN, Ely, MN, and over the Stanford University campus, CA were analyzed for fine spectral structure using two techniques: the ratio of radiance of a ground target to the radiance of a standard and also the correlation coefficient of radiances at adjacent wavelengths. The results show ramp like features in the ratios. These features are due to the biochemical composition of the leaf and to the optical scattering properties of its cuticle. The size and shape of the ramps vary with ground cover. Author

N86-11645*# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
REMOTE SENSING OF EARTH TERRAIN Semiannual Report, 1 Mar. - 31 Aug. 1985
J. A. Kong Aug. 1985 9 p refs
(Grant NAG5-270)
(NASA-CR-176284; NAS 1.26:176284) Avail: NTIS HC A02/MF A01 CSCL 08B

Progress on the investigation of the anisotropy of the terrain media, such as vegetation canopy and sea ice, and the study of the fluctuation-dissipation theorem in conjunction with the application of strong fluctuation theory for passive remote sensing of snowpacks is reported. The Feynman diagrammatic technique is used to derive the Dyson equation for the mean field and the Bethe-Salpeter equation for the correlation or the covariance of the field for electromagnetic wave propagation and scattering in an anisotropic random medium. With the random permittivity expressed in a general form, the bilocal and the nonlinear approximations are employed to solve the Dyson equation and the ladder approximation to the Bethe-Salpeter equation. The mean dyadic Green's function for a two layer anisotropic random medium with arbitrary three dimensional correlation function was investigated with the zeroth-order solutions to the Dyson equation under the four characteristic waves associated with the coherent vector fields propagating in an anisotropic random medium layer, which are the ordinary and extraordinary waves with upward and downward propagating vectors. Author

N86-11646*# Maryland Univ., College Park. Dept. of Geography.
ANALYSIS OF TERRESTRIAL CONDITIONS AND DYNAMICS Progress Report, 1 Sep. 1984 - 30 Jun. 1985
Samuel N. Goward Jun. 1985 103 p refs
(NCC5-26)
(NASA-CR-176308; NAS 1.26:176308) Avail: NTIS HC A06/MF A01 CSCL 05B

An ecological model is developed to estimate annual net primary productivity of vegetation in twelve major North American biomes. Three models are adapted and combined, each addressing a different factor known to govern primary productivity, i.e., photosynthesis, respiration, and moisture availability. Measures of intercepted photosynthetically active radiation (1PAR) for input to the photosynthesis model are derived from spectral vegetation index data. Normalized Difference Vegetation Index (NDVI) data are produced from NOAA-7 Advanced Very High Resolution Radiometer (AVHRR) observations for April 1982 through March 1983. NDVI values are sampled from within the biomes at locations for which climatological data are available. Monthly estimates of Net Primary Productivity (NPP) for each sample location are generated and summed over the twelve month period. These monthly estimates are averaged to produce a single annual estimated NPP value for each biomes. Comparison of estimated NPP values with figures reported in the literature produces a correlation coefficient of 85. Author

N86-11647*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ACTIVE AND PASSIVE MICROWAVE MEASUREMENTS IN HURRICANE ALLEN
Victor E. Delnore (PRC Kentron, Inc.), Gilbert S. Bahn, William L. Grantham (Harris Corp., Melbourne, Fla.), Richard F. Harrington, and W. Linwood Jones Washington Nov. 1985 146 p refs
(NASA-TM-86390; L-15775; NAS 1.15:86390) Avail: NTIS HC A07/MF A01 CSCL 04B

The NASA Langley Research Center analysis of the airborne microwave remote sensing measurements of Hurricane Allen obtained on August 5 and 8, 1980 is summarized. The instruments were the C-band stepped frequency microwave radiometer and the Ku-band airborne microwave scatterometer. They were carried aboard a NOAA aircraft making storm penetrations at an altitude of 3000 m and are sensitive to rain rate, surface wind speed, and surface wind vector. The wind speed is calculated from the increase in antenna brightness temperature above the estimated calm sea value. The rain rate is obtained from the difference between antenna temperature increases measured at two frequencies, and wind vector is determined from the sea surface normalized radar cross section measured at several azimuths. Comparison wind data were provided from the inertial navigation systems aboard both the C-130 aircraft at 3000 m and a second NOAA aircraft (a P-3) operating between 500 and 1500 m. Comparison rain rate data were obtained with a rain radar aboard the P-3. Evaluation of the surface winds obtained with the two microwave instruments was limited to comparisons with each other and with the flight level winds. Two important conclusions are drawn from these comparisons: (1) the radiometer is accurate when predicting flight level wind speeds and rain; and (2) the scatterometer produces well behaved and consistent wind vectors for the rain free periods. Author

N86-11648# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
THERMAL CONVECTION IN SNOW
D. J. Powers, S. C. Colbeck, and K. ONeill May 1985 69 p
(AD-A157577; CRREL-85-9) Avail: NTIS HC A04/MF A01 CSCL 08/12

Large temperature gradients applied to a snow cover drive water vapor upward and result in rapid recrystallization of snow crystals. The same temperature gradients create gradients of air density that can cause flows of air through the snow cover. This report develops formalism necessary to describe these flows in an effort to include the convection of vapor in the understanding of snow metamorphism. The theory of convection through porous media is extended to include the transport of water vapor, which is important because of its latent heat. Results are presented in terms of a Lewis number, defined as the ration of thermal to mass diffusivities. For Lewis numbers greater than 1.0, phase change intensifies convection, and for Lewis numbers less than 1.0, phase change retards convection. Two boundary conditions of special interest in the study of snow, a constant heat flux bottom and a permeable top, are investigated. Their influence on the transfer of heat is quantified, and it is found that heat transfer can be described as a linear function of the driving force for convection. The effect of a permeable top on convection at low Rayleigh numbers is derived. Experiments are performed to measure the effects of convection on heat transfer through glass beads and snow. The model results using constant flux boundary conditions are confirmed by experiments. Experiments show that convection can occur in snow, and that convection behaves in a manner consistent with our theoretical understanding of the phenomenon. Some uncertainty exists about the permeability and thermal conductivity of snow and hence it is uncertain if thermal convection would occur for a given temperature gradient, density and thickness. GRA

N86-11649# Department of Energy, Morgantown, W. Va.
ARCTIC ENERGY TECHNOLOGIES WORKSHOP: PROCEEDINGS
Apr. 1985 225 p Workshop held in Morgantown, W. Va., 14 Nov. 1984
(DE85-003360; DOE/METC-85/6014; CONF-8411108) Avail: NTIS HC A10/MF A01

Arctic oil and gas development program areas are discussed.

Technical information exchange among engineers, geologists, geophysicists, physical scientists, oceanographers, statisticians, analysts, and other participants engaged in similar research areas was provided. The first section of the proceedings is the keynote address. The second section of the proceedings includes 14 technical papers presented in two sessions at the Workshop: Sea Ice Research, and Seafloor/Soils Research. The third section of the proceedings includes the summaries of four work group discussion sessions from the second day of the meeting: (1) Arctic Offshore Structures; (2) Arctic Offshore Pipelines; (3) Subice Development Systems; and (4) Polar-Capable Ice Vessels. DOE

N86-11650# Washington State Energy Office, Olympia.
EVALUATION AND RANKING OF GEOTHERMAL RESOURCES FOR ELECTRICAL GENERATION OR ELECTRICAL OFFSET IN IDAHO, MONTANA, OREGON AND WASHINGTON Executive Summary
R. G. Bloomquist Jun. 1985 28 p refs
(Contract DE-AI79-83BP-13609)
(DE85-014661; DOE/BP-13609/3; WAOENG-85-02c) Avail: NTIS HC A03/MF A01

All geologic, environmental, legal, and institutional information in existing records and files was consolidated and evaluated, and a uniform methodology was applied to the evaluation and ranking of all known geothermal sites. The four states identified a total of 1265 potential geothermal sites. The 1265 sites were screened to eliminate those with little or no chance of providing either electrical generation and/or electrical offset. Two hundred and forty-five of the original 1265 sites were determined to warrant further study. On the basis of a developability index, 78 high temperature sites and 120 direct utilization sites were identified as having good or average potential for development and should be studied in detail. On the basis of cost, at least 29 of the high temperature sites appear to be technically capable of supporting a minimum total of at least 1000 MW of electrical generation which could be competitive with the busbar cost of conventional thermal generating technologies. DOE

N86-11651# Geological Survey, Anchorage, Alaska.
THE 1984 ANNUAL REPORT ON ALASKA'S MINERAL RESOURCES
1985 55 p
(DE85-015235; USGS-CIRC-940) Avail: NTIS HC A04/MF A01

Section 1011 of the Alaska National Interest Lands Conservation Act requires that on or before October 1, 1982, and annually thereafter, the President shall transmit to Congress all pertinent public information relating to minerals in Alaska gathered by the United States Geological Survey, the Bureau of Mines, and any other Federal agency. This is the third report to be prepared in response to that requirement. This report addresses onshore areas of Alaska only. It provides information about minerals of current interest in two broad categories: energy resources and nonfuel, critical, and strategic minerals. DOE

N86-11652# Analytic and Computational Research, Inc., Los Angeles, Calif.
PROBABILITY ENCODING OF HYDROLOGIC PARAMETERS FOR BASALT. ELICITATION OF EXPERT OPINIONS FROM A PANEL OF THREE BASALT WASTE ISOLATION PROJECT STAFF HYDROLOGISTS
A. K. Runchal, M. W. Merkhofer, E. Olmsted, and J. D. Davis Nov. 1984 73 p Prepared in cooperation with Applied Decision Analysis, Inc. and Rockwell International Corp., Richland, Wash.
(Contract DE-AC06-77RL-01030)
(DE85-014665; RH0-EW-CR-146P) Avail: NTIS HC A04/MF A01

A probability encoding method to estimate the probability distributions of selected hydrologic variables for the Cohassett basalt flow top and flow interior, and the anisotropy ratio of the interior of the Cohassett basalt flow beneath the Hanford Site was conducted. The results indicate significant differences of opinion among the experts. This was especially true of the values of the effective porosity of the Cohassett basalt flow interior for which estimates differ by more than five orders of magnitude. The experts are in greater agreement about the values of effective porosity of the Cohassett basalt flow top; their estimates for this variable are generally within one to two orders of magnitude of each other. For anisotropy ratio, the expert estimates are generally within two or three orders of magnitude of each other. Based on this study, the Rockwell hydrologists estimate the effective porosity of the Cohassett basalt flow top to be generally higher than do the independent experts. For the effective porosity of the Cohassett basalt flow top, the estimates of the Rockwell hydrologists indicate a smaller uncertainty than do the estimates of the independent experts. On the other hand, for the effective porosity and anisotropy ratio of the Cohassett basalt flow interior, the estimates of the Rockwell hydrologists indicate a larger uncertainty than do the estimates of the independence experts. DOE

N86-11653# Department of Energy, Morgantown, W. Va.
STATUS OF MODELS FOR ANALYSIS OF WESTERN GAS SANDS
A. I. Horton and A. W. Layne Apr. 1985 53 p refs
(DE85-003398; DOE/METC-85/2004) Avail: NTIS HC A04/MF A01

Existing capabilities for computer modeling of tight gas sands are summarized. The emphasis is on reservoir and stimulation model applicable to tight (low permeability), lenticular reservoirs (formations of irregularly shaped, randomly distributed sandstone bodies surrounded by relatively impermeable reservoir rock). These types of reservoirs are the focus of the Department of Energy's (DOE) Western Gas Sands (WGS) research efforts. The subject was addressed to assist DOE program managers and reservoir modelers in determining the needs for refining modeling capabilities for WGS research. Existing models are identified and their technical features and data requirements are discussed. The general benefits and problems in using models and suggested improvements for research-oriented models are covered. DOE

N86-11654# Urban Systems Research and Engineering, Inc., Cambridge, Mass.
EVALUATION OF COLOR INFRARED AERIAL SURVEYS OF WASTEWATER SOIL ABSORPTION SYSTEMS Final Report
S. O. Farrell Apr. 1985 83 p refs
(Contract EPA-68-03-3057)
(PB85-189074; EPA-600/2-85-039) Avail: NTIS HC A05/MF A01 CSCL 08B

Color infrared (CIR) aerial surveys can identify soil absorption systems in which the effluent rises rather than percolates into the ground water. This report reviews the technique's scientific basis and effectiveness, and discusses the procedures and equipment required for such surveys, and survey costs. Author (GRA)

N86-11655# Texas Dept. of Water Resources, Austin.
EVALUATING THE GROUND-WATER RESOURCES OF THE HIGH PLAINS OF TEXAS, VOLUME 3
T. Knowles, P. Norstrom, and W. B. Klemt Aug. 1985 425 p 4 Vol.
(PB85-191617; TDWR/R-2688-Vol-3) Avail: NTIS HC A18/MF A01; also available in set of 4 reports as PB85-191583 CSCL 08H

This report contains the basic data supporting counties in the middle third of the study as shown on the accompanying map which include records of approximately 12,200 wells, and county maps depicting well locations, elevation of the base of the High Plains aquifer, elevation of the water levels in 1980, and saturated thicknesses in 1980. GRA

N86-11656# Agricultural Research Service, Beltsville, Md.
HYDROLOGIC DATA FOR EXPERIMENTAL AGRICULTURAL WATERSHEDS IN THE US, 1975
J. B. Burford, J. L. Thurman, and R. T. Roberts Jan. 1985 587 p
(PB85-197317; USDA/MPUB-1446) Avail: NTIS HC A25/MF A01 CSCL 08H

Hydrologic data from 98 agricultural watersheds for calendar

year 1975 are summarized. Daily and monthly total precipitation and runoff together with annual maximum peak discharge and maximum runoff for selected time intervals are included. Watershed descriptive information is presented. Maximum and minimum daily temperatures are given to many of the watersheds. GRA

N86-11657*# National Academy of Sciences - National Research Council, Washington, D. C.
GEODESY: A LOOK TO THE FUTURE
1985 193 p refs Sponsored in part by NASA, Defense Mapping Agency, NOAA and Geological Survey
(NASA-CR-176283; NAS 1.26:176283; PB85-199578) Avail: NTIS HC A09/MF A01 CSCL 08E

The report deals with the current and future uses of contemporary geodetic data and poses some questions and possibilities for the future. It is anticipated that the document will generate interest in present and future geodetic data for the solution of problems in Earth, ocean, and atmospheric sciences. GRA

N86-11658# Wisconsin Univ., Madison. Dept. of Civil and Environmental Engineering.
AERIAL PHOTOGRAPHY AND GROUND VERIFICATION AT POWER PLANT SITES: WISCONSIN POWER PLANT IMPACT STUDY
S. L. Wynn and R. W. Kiefer Apr. 1985 293 p Prepared in cooperation with Wisconsin Dept. of Natural Resources, Madison, Wisconsin Public Service Commission, Madison and Wisconsin Public Service Corp., Green Bay
(Grant EPA-R-803971)
(PB85-197358; EPA-600/3-85-034) Avail: NTIS HC A13/MF A01 CSCL 06C

Nine methods for monitoring the deterioration of a large wetland on the site of a newly constructed coal fired power plant in Columbia County, Wisconsin were demonstrated and evaluated. Four of the nine methods used data from ground sampling; two were remote sensing methods without ground verification; and three were remote sensing methods which either used ground verification or relied on the analyst's on the ground knowledge of the area. These methods were evaluated on the basis of whether they monitor change at a species or a community level, whether they monitor community change in terms of area or location or both, and whether they provide information about trends in plant communities. GRA

N86-11659# Vermont Univ., Burlington. Water Resources Research Center.
FISCAL YEAR 1983 INSTITUTE PROGRAM REPORT, VERMONT WATER RESOURCES RESEARCH CENTER Final Report
L. L. Arris and E. A. Cassell Dec. 1984 71 p
(Grant DI-14-08-0001-G-873)
(PB85-214500) Avail: NTIS HC A04/MF A01 CSCL 08H

Using the Center's Five Year Plan for Water Research as a guide, investigations studied water management problems of the highest priority in Vermont, including water quality watershed management lake processes, groundwater, acid precipitation, water resources data management, and allocation of water resources. The Water Center supported five major water research/information dissemination projects during the year. For the second year the Vermont Water Center supported research dealing with acid precipitation. GRA

N86-11660# Louisiana State Univ., Baton Rouge.
INFORMATION DISSEMINATION FOR A BETTER UNDERSTANDING OF LOUISIANA'S WATER RESOURCES
B. Worm 20 Sep. 1985 36 p Prepared in cooperation with Louisiana State Univ., Baton Rouge
(Grant DI-14-08-0001-G-845)
(PB85-219079; USGS/G-845-22) Avail: NTIS HC A03/MF A01 CSCL 08H

The project involved the assessment of Louisiana citizen's needs for water resources information, and the identification, preparation, and dissemination of the information available through the Louisiana Water Resources Research Institute to meet these needs. During the needs assessment phase, it was found that a need for information on most aspects of water resources exists in Louisiana. One topic of major concern for the State, coastal zone water problems, has been addressed by Institute supported research, and the results of the research were used to develop educational materials for the public on these problems. The project, through the evaluation of the Institute's ability to satisfy the State's needs for water information through existing Institute information, revealed gaps between needs for information and existing information. The topics not previously addressed by the Institute were recommended for incorporation into the Institute's water research priorities listing. GRA

N86-11661# Louisiana State Univ., Baton Rouge. Water Resources Research Inst.
LOUISIANA WATER RESOURCES RESEARCH INSTITUTE Program Report, FY 1983
1985 31 p
(Grant DI-14-08-0001-G-845)
(PB85-218998; USGS/G-845-01) Avail: NTIS HC A03/MF A01 CSCL 08H

Five projects were supported by the Louisiana Water Resources Research Institute during the year 1983 to 1984. One project dealt with mathematical modeling of streamflow. The other project dealt with development of techniques for sediment analysis to isolate, concentrate and detect chlorinated hydrocarbons. Another project concentrated on treatment of coal pile runoff in Louisiana and suggested ways for treating the wastewater most effectively. The last project dealt with nutrient assimilation capacity in two shallow coastal lakes. GRA

N86-11662# Cornell Univ., Ithaca, N.Y. Center for Environmental Research.
FISCAL YEAR 1983 PROGRAM REPORT OF THE WATER RESOURCES RESEARCH INSTITUTE OF NEW YORK STATE Final Report
Sep. 1984 20 p
(Grant DI-14-08-0001-G-859; Proj. G859-01)
(PB85-217024; USGS/G-859-01) Avail: NTIS HC A02/MF A01 CSCL 08H

The Institute Water Resources Research Program for FY 1983 focused on three problem areas identified as critical in the Middle Atlantic Region; groundwater protection and management; acid precipitation; and water resources planning. The groundwater protection and management research program addressed problems of quality protection and the technology transfer program focused on related problems of management and information dissemination. The acid precipitation research projects focused on the effects of the phenomenon; on tree pollen germination and tube growth and use of induced fluorescence measurements to assess aluminum organic interactions in acidified lakes. The project relating to water resources planning developed a methodology for estimating the frequency, severity and duration of water supply shortage in existing water supply systems which rely on both surface and ground water. GRA

N86-11553# Academy of Sciences, Potsdam (East Germany). Zentralinst. fuer Physik der Erde.
NEW ASPECTS OF THE GEODETIC BOUNDARY VALUE PROBLEMS
K. Arnold *In its* Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth 1985 p 45-50 refs (For primary document see N86-11549 02-42)
Avail: NTIS HC A09/MF A01

N86-11555# Institut Geographique National, Paris (France). Groupe de Recherches de Geodesie Spatiale.
ESTABLISHMENT OF THE BIH TERRESTRIAL SYSTEM BY COMBINING THE RESULTS OF DIFFERENT EARTH ROTATION SPACE GEODESY PROGRAMS Abstract Only
Claude Boucher and Martine Feissel (Observatoire de Paris) *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth 1985 p 60 (For primary document

see N86-11549 02-42)
Avail: NTIS HC A09/MF A01

N86-11556# Ceskoslovenska Akademie Ved, Prague. Astronomical Inst.
TIDAL FRICTION, THE EARTH'S ROTATION AND HYPOTHESIS OF AN EXPANDING EARTH
Milan Bursa *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth 1985 p 61-67 refs (For primary document see N86-11549 02-42)
Avail: NTIS HC A09/MF A01

N86-11561# Technische Hochschule, Darmstadt (West Germany). Inst. fuer Physikalische Geodaesie.
PRECISE GEOID COMPUTATIONS AT MOUNTAINOUS COASTLINES IN VIEW OF VERTICAL DATUM DETERMINATIONS
H. J. Euler, E. Groten, W. Hausch, and B. Stock *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth 1985 p 109-139 refs (For primary document see N86-11549 02-42)
Avail: NTIS HC A09/MF A01

N86-11567# Academy of Sciences, Potsdam (East Germany). Zentralinsts fuer Physik der Erde.
RESULTS CONCERNING RHEOLOGICAL PARAMETERS OF THE EARTH
Joachim Hoepfner *In its* Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth 1985 p 173-176 refs (For primary document see N86-11549 02-42)
Avail: NTIS HC A09/MF A01

N86-11569# Research Inst. of Geodesy, Prague (Czechoslovakia).
A NEW APPROACH TO ITERATIONS IN SOLVING GEODETIC BOUNDARY VALUE PROBLEMS FOR REAL TOPOGRAPHY
Petr Holota *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 2 1985 p 4-15 refs (For primary document see N86-11568 02-42)
Avail: NTIS HC A09/MF A01

N86-11570# Higher Inst. of Mining and Geology, Sofia (Bulgaria).
THE IRREGULARITY IN THE EARTH'S ANNUAL ROTATION AS A CAUSE OF SYSTEMATIC TIME VARIATION
I. B. Ivanov *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 2 1985 p 16-18 refs (For primary document see N86-11568 02-42)
Avail: NTIS HC A09/MF A01

N86-11574# Polish Academy of Sciences, Warsaw. Space Research Centre.
ON SHORT PERIODICAL VARIATIONS OF POLAR MOTION AND UT1-UTC
B. Kolaczek, A. Brzezinski, W. Kosek, J. Nastula, and B. Soloducha *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 2 1985 p 35-44 refs (For primary document see N86-11568 02-42)
Avail: NTIS HC A09/MF A01

N86-11580# Technische Univ., Graz (Austria). Inst. of Theoretical Geodesy.
VARIATIONAL PRINCIPLES FOR EARTH ROTATION
Helmut Moritz *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 2 1985 p 88-101 refs (For primary document see N86-11568 02-42)
Avail: NTIS HC A09/MF A01

N86-11581# Stazione Astronomica Internazionale di Latitudine, Cagliari (Italy).
SECULAR AND LONG TERM VARIATIONS IN POLAR MOTION FROM CLASSICAL AND DOPPLER OBSERVATIONS
A. Poma and E. Proverbio (Ist. di Astronomia e Fisica Superiore, Cagliari, Italy) *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 2 1985 p 101-108 refs (For primary document see N86-11568 02-42)
Avail: NTIS HC A09/MF A01

N86-11585# Ceskoslovenska Akademie Ved, Prague. Geophysical Inst.
GEODYNAMIC EFFECTS DUE TO EARTH'S DEFORMATION
Jiri Tresl *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 2 1985 p 128-133 refs (For primary document see N86-11568 02-42)
Avail: NTIS HC A09/MF A01

N86-11587# Ceskoslovenska Akademie Ved, Prague. Astronomical Inst.
POLAR MOTION BETWEEN 1900.0 AND 1984.0 AS DETERMINED BY DIFFERENT TECHNIQUES Abstract Only
J. Vondrak *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 2 1985 p 143 (For primary document see N86-11568 02-42)
Avail: NTIS HC A09/MF A01

N86-11595# Academy of Sciences, Potsdam (East Germany). Zentralinst. fuer Physik der Erde.
SPACE-TIME VARIATING GEOLOGICAL MASSES BY SPACE-TIME VARIATING GEODETIC MEASUREMENTS
K. Arnold *In its* Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 26-31 refs (For primary document see N86-11591 02-42)
Avail: NTIS HC A08/MF A01

N86-11984# Joint Publications Research Service, Arlington, Va.
GENERAL-PURPOSE EQUIPMENT FOR AIRBORNE LASER REMOTE SENSING OF OCEAN, ATMOSPHERE AND AGRICULTURAL CROPS Abstract Only.
A. F. Bunkin, D. V. Vlasov, A. S. Glaumyan, D. V. Maltsev, D. M. Mirkamilov, and V. P. Slobodyanin *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 94 refs Transl. into ENGLISH from Zh. Tekhn. Fiz. (Leningrad), v. 54, no. 11, Nov. 1984 p 2190-2195 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

N86-11927# Joint Publications Research Service, Arlington, Va.
RESEARCH ON OPTIC SPATIAL FREQUENCY ANALYSIS OF LINEAR STRUCTURES IN REMOTE SENSING IMAGES Abstract Only
Ziqiang Zhu, Zhenpei Chen, Jitao Li, and Guangjie Tang *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-014) 2 May 1985 p 79 Transl. into ENGLISH from Zhongguo Jiguang (Shanghai), v. 12, no. 1, 20 Jan. 1985 p 1-5 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N86-11663# Vitro Labs., Silver Spring, Md.
PERFORMANCE OF SOLAR COLLECTOR ARRAYS AND COLLECTOR CONTROLLERS IN THE NATIONAL SOLAR DATA NETWORK
T. L. Logee and P. W. Kendall Jul. 1984 244 p refs
(Contract DE-AC01-79CS-30027)
(DE85-001297; Solar/0015-84-32) Avail: NTIS HC A11/MF A01

The accumulated National Solar Data Network (NSDN) data has been analyzed with regard to collector and collector control performance. The collector data is presented in the ASHRAE format

as efficiency vs. operating points, (Tinlet - Tambient)/insolation. Collector controls were analyzed by determining the losses caused by control problems common to the NSDN solar systems. This study of collectors and collector controls has several objectives which are: (1) to compare actual and predicted collector performance; (2) to determine which generic types of components performed well and which performed poorly; (3) to determine why predicted performance was not achieved in the field; (4) to determine the types and causes of failures; (5) to determine the reliability weaknesses; and (6) to determine whether there are any component integration problems. Author

N86-11664*# Solenergy Corp., Woburn, Mass.
INTERMEDIATE LOAD MODULES FOR TEST AND EVALUATION: FIXED PRICE RESEARCH AND DEVELOPMENT Final Report
22 Mar. 1985 16 p Prepared in cooperation with JPL, Pasadena, Calif.
(Contract NAS7-100)
(NASA-CR-176135; JPL-9950-1157; NAS 1.26:176135; DOE/JPL-956347-1; DRL-185; DRD-SE-2) Avail: NTIS HC A02/MF A01 CSCL 10B

Solenergy was contracted by JPL to furnish solar modules for evaluation of design test specification for intermediate load modules. Jet Propulsion Laboratory has performed qualification tests on Group 1 and Group 2 modules and has reported the resulting data. Modules were provided that are designed to be consistent with the Block 5 Electrical and Mechanical Design Requirements. Also these modules must meet the design requirements of Block 5 Environmental Design Requirements. It is felt that the modules performed satisfactorily although some workmanship problem were noted helping to correct production. It also appears that further work on EVA lamination by interested parties is required to address some problems associated with this method of production. Author

N86-11665# Solarex Corp., Rockville, Md.
THE INTERFACE STRUCTURE OF GRAIN BOUNDARIES IN POLYSILICON
S. M. Johnson, K. C. Yoo (Maryland Univ., College Park), R. G. Rosemeier (Maryland Univ., College Park), P. Soltani (Semix, Inc.), and H. C. Lin 1982 35 p refs Presented at Mater. Res. Soc. Ann. Meeting, Boston, 1-4 Nov., 1982
(Contract DE-FC01-80-ET-23197)
Avail: NTIS HC A03/MF A01

Normal grain growth in polysilicon material proceeds by a twinning mechanism such that the individual grain orientations are related by single or multiple twinning steps. The twinning relationship between adjacent grains can result in the alignment of their boundary interfaces along certain planar segments which have a very low electrical activity. The varying degree of electrical activity of these boundaries, and boundary positions, is attributed to the smaller dislocation portion of the larger change in orientation across the grains. Author

N86-11666*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PHOTOVOLTAIC-POWERED VACCINE REFRIGERATOR: FREEZER SYSTEMS FIELD TEST RESULTS Final Report
Anthony F. Ratajczak Aug. 1985 99 p
(DE-AI01-79ET-20485; PASA-NASA/DSB-5710-2-79)
(NASA-TM-86972-Rev; E-2498; DOE/NASA/20485-18; NAS 1.15:86972-Rev) Avail: NTIS HC A05/MF A01 CSCL 10B

A project to develop and field test photovoltaic-powered refrigerator/freezers suitable for vaccine storage was undertaken. Three refrigerator/freezers were qualified; one by Solar Power Corp. and two by Solvolt. Follow-on contracts were awarded for 19 field test systems and for 10 field test systems. A total of 29 systems were installed in 24 countries between October 1981 and October 1984. The project, systems descriptions, installation experiences, performance data for the 22 systems for which field test data was reported, an operational reliability summary, and recommendations relative to system designs and future use of such systems are explained. Performance data indicate that the systems are highly reliable and are capable of maintaining proper vaccine storage temperatures in a wide range of climatological and user environments. Author

N86-11667*# Michigan State Univ., East Lansing. Div. of Engineering Research.
EFFECT OF ACCURACY OF WIND POWER PREDICTION ON POWER SYSTEM OPERATOR Final Report
Robert A. Schlueter, G. Sigari, and T. Costi Jun. 1985 188 p refs
(Grant NAG3-399)
(NASA-CR-176300; NAS 1.26:176300; MSU-ENGR-85-026) Avail: NTIS HC A09/MF A01 CSCL 10B

This research project proposed a modified unit commitment that schedules connection and disconnection of generating units in response to load. A modified generation control is also proposed that controls steam units under automatic generation control, fast responding diesels, gas turbines and hydro units under a feedforward control, and wind turbine array output under a closed loop array control. This modified generation control and unit commitment require prediction of trend wind power variation one hour ahead and the prediction of error in this trend wind power prediction one half hour ahead. An improved meter for predicting trend wind speed variation is developed. Methods for accurately simulating the wind array power from a limited number of wind speed prediction records was developed. Finally, two methods for predicting the error in the trend wind power prediction were developed. This research provides a foundation for testing and evaluating the modified unit commitment and generation control that was developed to maintain operating reliability at a greatly reduced overall production cost for utilities with wind generation capacity. Author

N86-11668*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RE-1000 FREE-PISTON STIRLING ENGINE UPDATE
J. G. Schreiber 1985 20 p refs Presented at the 20th Intersoc. Energy Conversion Eng. Conf., Miami Beach, Fla., 18-23 Aug. 1985
(Contract DE-AI05-82OR-1005)
(NASA-TM-87126; E-2597; DOE/NASA/1005-6; NAS 1.15:87126) Avail: NTIS HC A02/MF A01 CSCL 10B

A free piston Stirling engine was tested. The tests performed over the past several years on the single cylinder engine were designed to investigate the dynamics of a free piston Stirling engine. The data are intended to be used primarily for computer code validation. The tests designed to investigate the sensitivity of the engine performance to variations in working space pressure, heater and cooler temperatures, regenerator porosity, power piston mass and displacer dynamics were completed. In addition, some data were recorded with alternate working fluids. A novel resonant balance system for the engine was also tested. Some preliminary test results of the tests performed are presented along with an outline of future tests to be run with the engine coupled to a hydraulic output unit. A description of the hydraulic output unit is given. Author

N86-11669*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A SUMMARY REPORT ON THE FLAT-PLATE SOLAR ARRAY PROJECT WORKSHOP ON TRANSPARENT CONDUCTING POLYMERS
R. Kachare and J. Moacanin 1 Aug. 1985 51 p Workshop held in Santa Barbara, Calif., 11-12 Jan. 1985
(Contract NAS7-918; DE-AI01-76ET-20356)
(NASA-CR-176302; NASA-JPL-85-60; NAS 1.26:176302; DOE/JPL-1012-110) Avail: NTIS HC A04/MF A01 CSCL 10B

The proceedings and technical discussions of a workshop on Transparent Conducting Polymers (TCP) for solar cell applications are reported. This is in support of the Device Research Task of the Flat-Flate Solar Array Project. The workshop took place on January 11 and 12, 1985, in Santa Barbara, California. Participants

included university and industry researchers. The discussions focused on the electronic and optical properties of TCP, and on experimental issues and problems that should be addressed for high-efficiency solar cell application. Author

N86-11670*# Michigan State Univ., East Lansing. Div. of Engineering Research.
AC MOTOR AND GENERATOR REQUIREMENTS FOR ISOLATED WECS
Gerald L. Park, Patrick J. McCleer (Michigan Univ.), Bror Hanson (SWX Corp.), Bernhard Weinberg, and Otto Krauss Oct. 1985 82 p refs
(Grant NAG3-530)
(NASA-CR-176315; DOE/NASA/0530-1; NAS 1.26:176315) Avail: NTIS HC A05/MF A01 CSCL 10A

After surveying electrically driven loads used on productive farms, the investigators chose three pumps for testing at voltages and frequencies far outside the normal operating range. These loads extract and circulate water and move heat via air, and all are critical to farm productivity. The object was to determine the envelope of supply voltage and frequency over which these loads would operate stably for time intervals under 1 hour. This information is among that needed to determine the feasibility of supplying critical loads, in case of a utility outage, from a wind driven alternator whose output voltage and frequency will vary dramatically in most continental wind regimes. Other related work is surveyed. The salient features and limitations of the test configurations used and the data reduction are described. The development of simulation models suitable for a small computer are outlined. The results are primarily displayed on the voltage frequency plane with the general conclusion that the particular pump models considered will operate over the range of 50 to 90 Hz and a voltage band which starts below rated, decreases as frequency decreases, and is limited on the high side by excessive motor heating. For example, centrifugal pump operating voltage ranges as extensive .4 to 1.4 appear possible. Particular problems with starting, stalling due to lack of motor torque, high speed cavitation, and likely overheating are addressed in a listing of required properties for wind driven alternators and their controllers needed for use in the isolated or stand alone configuration considered. Author

N86-11671*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A 25.5 PERCENT AMO GALLIUM ARSENIDE GRATING SOLAR CELL
V. G. Weizer and M. P. Godlewski 1985 10 p refs Presented at the 18th Photovoltaic Specialists Conf., Las Vegas, Nev., 21-25 Oct. 1985; sponsored by IEEE
(NASA-TM-87134; E-2748; NAS 1.15:87134) Avail: NTIS HC A02/MF A01 CSCL 10A

Recent calculations have shown that significant open circuit voltage gains are possible with a dot grating junction geometry. The feasibility of applying the dot geometry to the GaAs cell was investigated. This geometry is shown to result in voltages approach 1.120 V and efficiencies well over 25 percent (AMO) if good collection efficiency can be maintained. The latter is shown to be possible if one chooses the proper base resistivity and cell thickness. The above advances in efficiency are shown to be possible in the P-base cell with only minor improvements in existing technology. Author

N86-11672# Naval Surface Weapons Center, White Oak, Md.
HIGH RATE LI/SOCI(2) CELLS. 2. EFFECT OF CATALYST ON CELL PERFORMANCE Report, Nov. 1983 - Apr. 1985
W. P. Kilroy, L. Pitts, and K. M. Abraham Apr. 1985 59 p
(AD-A157383; NSWC/TR-85-104) Avail: NTIS HC A04/MF A01 CSCL 10/3

As part of the ongoing High Energy Batteries for Weapons Programs at NSWC, various cell parameters were investigated to examine their effect on the performance, safety, and chemistry of Li/SOCl2 cells. This report summarizes the influence of cobalt dibenzo-tetraazaannulene (Co-TAA) catalysis on the discharge and overdischarge chemistry and performance of spirally wound commercial C-size cells. Co-TAA catalyst improved the performance and safety of C-size Li/SOCl2 cells. The catalyst was most effective at high rate or low temperature operation. The presence of water increased the risk of hazards at high rates of discharge. The generation of gases such as COS, CS2, HCl, etc. was dependent on the internal temperature. GRA

N86-11673# EIC, Inc., Norwood, Mass.
BASIC STUDIES OF THE LITHIUM SECONDARY BATTERY Final Technical Report, 1 May 1984 - 30 Apr. 1985
J. S. Foos, S. M. Erker, and L. M. Rembetsy Jun. 1985 19 p
(Contract N00014-84-C-0336)
(AD-A157449; C-804; FTR-1) Avail: NTIS HC A02/MF A01 CSCL 10/3

Poly-1, 4-dimethoxybenzene has been synthesized by the anodic oxidation of 1,4-dimethoxybenzene in aprotic electrolytes. The black polymer is a doped semiconductor as formed. This material is converted to polymeric (olimeric) hydroquinone and quinone. The polymers are insoluble in all common solvents except for the polyhydroquinone in aqueous base. A coulombic titration of this quinone, using an electrode compounded with carbon and an aprotic electrolyte, gave an equivalent weight corresponding to approx. 0.5e(-) per quinone unit. Similar results were observed in the initial cycles in Li cells. However, the capacity of the electrode degraded on cycling. GRA

N86-11674# Thermo Electron Corp., Waltham, Mass.
ADVANCED THERMIONIC TECHNOLOGY PROGRAM: SUMMARY REPORT, VOLUME 3 Final Report
Oct. 1984 130 p refs Prepared in cooperation with Rasor Associates, Inc., Sunnyvale, Calif.
(Contracts DE-AC02-76ET-11292; DE-AC21-83MC-20352)
(DE85-009360; DOE/ET-11292/1893-Vol-3) Avail: NTIS HC A07/MF A01

The results of systems studies of primary interest to those involved in identifying and evaluating applications for thermionics are presented. Several of the industries which consume the largest amounts of energy have an electrical-to-thermal ratio of about ten percent. This closely matches the electrical efficiency of thermionic converters. Thermionic cogeneration has several other unique advantages relative to alternative technologies for cogeneration which should lead to a much broader application of cogeneration in industry. These advantages accrue from the much higher temperatures at which thermionic energy conversion takes place, its suitability for very small as well as large process heaters, and, of course, its production of direct heat rather than process steam. Several examples of thermionic cogeneration are presented in greater detail: copper refining by the Noranda process; thermionic topping cycles or gas turbine; and combined cycle and fossil-fuel steam power plants. DOE

N86-11675# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
NEW-GENERATION PHOTOVOLTAIC TECHNOLOGIES
T. Surek and R. D. McConnell Jun. 1985 7 p Presented at INTERSOL '85 - Solar Energy, the Diverse Solution, Montreal, 23 Jun. 1985
(Contract DE-AC02-83CH-10093)
(DE85-012143; SERI/TP-211-2748; CONF-850604-11) Avail: NTIS HC A02/MF A01

Five generations of photovoltaic technologies are identified: single crystal silicon, polycrystalline silicon, ribbon silicon, single junction thin films, and multijunction thin films. The Solar Energy Research Institute (SERI) is the focus for the US government's research and development of the most promising, the fourth and fifth generation single-junction and multijunction thin films. Improvements in materials and solar cell fabrication techniques have resulted in remarkable progress for thin-film devices in recent years. Some recent highlights of SERI's photovoltaic research efforts are described. Author

N86-11676# Utah Geological and Mineralogical Survey, Salt Lake City.
SUMMARY OF LOW-TEMPERATURE GEOTHERMAL STUDIES CONDUCTED BY THE UTAH GEOLOGICAL AND MINERAL SURVEY FROM JULY 1, 1977 TO DECEMBER 31, 1984
R. H. Klauk Dec. 1984 20 p refs
(Contract DE-AS07-77ET-28393)
(DE85-009346; DOE/ET-28393/T9; RI-193) Avail: NTIS HC A02/MF A01

Brief summaries of the results of studies of low-temperature geothermal areas are presented. These include state-wide studies, site-specific studies, and area studies. DOE

N86-11677# GeoProducts Corp., Oakland, Calif.
HONEY LAKE GEOTHERMAL PROJECT, LASSEN COUNTY, CALIFORNIA Final Technical Report
Nov. 1984 61 p
(Contract DE-FC07-81ID-12262)
(DE85-013388; DOE/ID-12262/T1) Avail: NTIS HC A04/MF A01

The drilling, completion, and testing of deep well WEN-2 for a hybrid electric power project which will use the area's moderate temperature geothermal fluids and locally procured wood fuel is reported. The project is located within the Wendel-Amedee Known Geothermal Resource Area. DOE

N86-11678# Stanford Univ., Calif. Geothermal Program.
TRACER TEST ANALYSIS OF THE KLAMATH FALLS GEOTHERMAL RESOURCE: A COMPARISON OF MODELS
S. E. Johnson Jun. 1985 116 p refs
(Contract DE-AT03-80SF-11459)
(DE85-009924; SGP-TR-81) Avail: NTIS HC A06/MF A01

Two tracer tests on doublet systems in a fractured geothermal system were carried out to obtain data which would lead to information about the reservoir and to test the applicability of current tracer flow models. The results show rapid breakthrough times and indicate fracture flow with vigorous mixing of injector fluid before production of same are shown. It is suggested that thermal breakthrough is not directly related to tracer breakthrough in the Klamath Union doublet system. There has been no long-term enthalpy loss from exploiting the resource for 40 years. To reduce the data, models were developed to analyze the results. Along with a porous media flow model two mathematical models developed to analyze fractured geothermal systems are used to help dicipher the various tracer return curves. The flow of tracers in doublet systems was investigated. A mathematical description is used for tracer flow through fractures as a function of time and various nonlinear parameters which can be found using a curve fitting technique. DOE

N86-11679# Sandia Labs., Albuquerque, N. Mex.
VERTICAL AXIS WIND TURBINE POWER REGULATION THROUGH CENTRIFUGALLY PUMPED LIFT SPOILING
P. C. Klimas and J. F. Sladky, Jr. (Washington Univ., Seattle) 1985 5 p refs Presented at INTERSOL 1985. Solar Energy: The Diverse Solution, Montreal, 23 Jun. 1985
(Contract DE-AC04-76DP-00789)
(DE85-013787; SAND-85-1408C; CONF-850604-3) Avail: NTIS HC A02/MF A01

This paper describes an approach for lowering the rated windspeeds of Darrieus-type vertical axis wind turbines (VAWTs) whose blades are hollow aluminum extrusions. The blades, which when rotating act as centrifugal pumps, are fitted with a series of small perforations distributed along a portion of the blades' span. By valving the ends of the hollow blades, flow into the blade ends and out of the perforations may be controlled. This flow can induce premature aerodynamic stall on the blade elements, thereby reducing both the rated power of the turbine and its cost-of-energy. The concept has been proven on the Sandia National Laboratories 5-m diameter research VAWT and force balance and flow visualization wind tunnel tests have been conducted using a blade section designed for the VAWT application. DOE

N86-11680# Oak Ridge National Lab., Tenn.
STIRLING CYCLE HEAT PUMP STUDIES
N. Domingo 1984 8 p Presented at the DOE/ORNL Heat Pump Conf., Washington, D.C., 10 Dec. 1984
(Contract DE-AC05-84OR-21400)
(DE85-005365; CONF-841231-6) Avail: NTIS HC A02/MF A01

Major accomplishments for the analytical activities in Stirling cycle heat pumps include: (1) a computer simulation of a kinematic SCHP to determine the effects of source temperature, gas pressure, drive speed, dead volume, and working-space isothermalization on performance; and (2) a comparative analysis of SCHP performance and loss terms obtained with two different computer models. Simulation results indicate some performance trends and trade-off relationships which may be general enough to cover a wide range of machine configurations. It is shown that overall performance agreement between the models is farily good, but for the individual losses, agreement is very poor. DOE

N86-11681# Sandia Labs., Albuquerque, N. Mex.
DEGRADATION OF IONIC MEMBRANES IN THE ZINC/FERRICYANIDE BATTERY
R. A. Assink and O. Arnold, Jr. 1985 20 p Presented at the Spring Natl. Meeting of AIChE, Houston, Tex., 24 Mar. 1985
(Contract DE-AC04-76DP-00789)
(DE85-008469; SAND-84-1953C; CONF-850357-4) Avail: NTIS HC A02/MF A01

Homogeneous and radiatively grafted membranes were evaluated as separators for the zinc/ferricyanide storage battery. An accelerated aging test demonstrated that membrane failures could be attributed to both mechanical and chemical mechanisms. A series of radiation grafted membranes using fluorinated film substrates were prepared. One of these membranes has exhibited a 79.3% average energy efficiency for over 700 charge/discharge cycles in a test cell. DOE

N86-11682# Oak Ridge National Lab., Tenn.
THERMODYNAMICS OF CHROMIUM AND IRON IN CARBONATE SALTS AT 650(0)C
H. S. Hsu and J. H. DeVan May 1985 25 p refs
(Contract DE-AC05-84OR-21400)
(DE85-013542; ORNL-6181) Avail: NTIS HC A02/MF A01

Chemical equilibria of chromium and iron in Li2CO3-K2CO3 were investigated in conjunction with corrosion studies of current collector materials for molten-carbonate fuel cells. The SOLGASMIX-PV computer program was used to perform thermochemical calculations to establish equilibrium phase relationships under various gas atmospheres at 650(0)C. Phase stability diagrams were constructed for the systems Cr-Li-C-O, Cr-K-C-O, Cr-Li-K-C-O, Fe-Li-C-O, Fe-K-C-O, and Fe-Li-K-C-O at 650(0)C. These predicted phase relationships were checked experimentally by thermogravimetric analysis, differential thermal analysis, and X-ray diffraction. The experimental results generally confirmed that reaction paths were consistent with the calculated phase stability diagrams. DOE

N86-11683# Washington State Energy Office, Olympia.
EVALUATION AND RANKING OF GEOTHERMAL RESOURCES FOR ELECTRICAL GENERATION OR ELECTRICAL OFFSET IN IDAHO, MONTANA, OREGON AND WASHINGTON, VOLUME 2
F. G. Bloomquist Jun. 1985 528 p
(Contract DE-AI79-83BP-13609)
(DE85-014452; DOE/BP-13609/2-Vol-2; WAOENG-85-02b-Vol-2) Avail: NTIS HC A23/MF A01

Appendices are given on: (1) resource assessments of electrical generation computer results; (2) a resource assessment summary of direct use computer results; (3) an electrical generation (high temperature) resource assessment computer program listing; (4) a direct utilization (low temperature) resource assessment computer program listing; (5) an electrical generation computer program CENTPLANT and related documentation; (6) an electrical generation computer program WELLHEAD and related documentation; (7) a direct utilization computer program HEATPLAN and related documentation; (8) an electrical generation ranking computer program GEORANK and related documentation; (9) a direct

utilization ranking computer program GEORANK and related documentation; and (10) a life cycle cost analysis computer program and related documentation. DOE

N86-11684# Utah Univ., Salt Lake City. Dept. of Materials Science and Engineering.
MULTISPECTROSCOPIC STUDIES OF THE ELECTRONIC STRUCTURE OF ELECTRODE MATERIALS FOR HIGH ENERGY DENSITY BATTERIES: 1-2, 1-3 INTERMETALLIC COMPOUNDS WITH B32 STRUCTURE Final Technical Report
I. M. Curelaru 2 Jul. 1985 23 p
(Contract DE-AT03-83ER-45011)
(DE85-014675; DOE/ER-45011/T1) Avail: NTIS HC A02/MF A01

The 1-2 and 1-3 intermetallic compounds with B32 (Zintl) structure which are promising candidates for electrode materials to be used in high energy density batteries or solid blankets for nuclear reactors are discussed. Optimal use of these important materials requires a satisfactory understanding of their structure and physicochemical properties. The work performed to initiate a systematic experimental study of the electronic structure and related properties of representative compounds in the 1-2 and 1-3 Zintl series is described. DOE

N86-11685# Los Alamos National Lab., N. Mex.
PASSIVE SOLAR APPLICATIONS
J. D. Balcomb 1985 8 p Presented at the Intern. Conf. on Solar and Wind Energy Appl. (ICSWEA), Beijing, China, 3 Aug. 1985
(Contract W-7405-eng-36)
(DE85-014085; LA-UR-85-2213; CONF-850888-1) Avail: NTIS HC A02/MF A01

Passive solar applications in buildings are described. The major emphasis of the research has been on devising mathematical models to characterize heat flow within buildings, on the validation of these models by comparison with test results, and on the subsequent use of the models to investigate the influence of both various design parameters and the weather on system performance. Results from both test modules and monitored buildings are discussed. Simulation analysis, the development of simplified methods, and systems analysis are outlined. Passive solar potential in China is discussed. DOE

N86-11686# Oregon State Univ., Corvallis. Wind Resources Assessment Lab.
REGIONAL WIND ENERGY ASSESSMENT PROGRAM. APPENDIX: WIND STATISTICS SUMMARIES Progress Report, Oct. 1983 - Sep. 1984
R. W. Baker, J. E. Wade, and R. J. Wittrup Feb. 1985 152 p refs
(DE85-011520; DOE/EP-388-App; BPA-84-18-App) Avail: NTIS HC A08/MF A01

The wind statistics given include summarized spectrum analyzer data, speed frequency distributions, and occurrences of winds of 50 mph or greater. Also mapped is the wind power prospecting flight path, with site locations numbered. DOE

N86-11687# Sandia Labs., Albuquerque, N. Mex.
ECONOMICS OF MAGMA POWER GENERATION
C. C. Carson and J. Haraden (Well Production Testing, Inc., Carlsbad, Calif.) 1985 5 p refs Presented at Intern. Symp. on Geothermal Energy, Kailua Kona, Hawaii, 26 Aug. 1985
(Contract DE-AC04-76DP-00789)
(DE85-008694; SAND-85-0648C; CONF-850801-6) Avail: NTIS HC A02/MF A01

An analysis of the economics of generating electricity using magma reservoirs as the energy source indicates that magma based energy could be roughly competitive with existing sources of electricity. The conclusion seems justified even though the analysis requires many assumptions that may or may not prove to be realistic as technology advances. Another important result of this analysis that is not dependent on the state of technology is the identification of the parameters that have the largest effect on the economics of magma energy. These include the initial cost and the lifetime of the wells that are drilled to reach the magma reservoir and the rate at which energy can be extracted from each well - the same parameters that control the economics of hydrothermal resources. The technological improvements that affect these parameters will be the focus of the continuing magma energy extraction program. DOE

N86-11688# Sandia Labs., Albuquerque, N. Mex.
USE OF SiO2 AND TiO2 SOL-GEL ANTIREFLECTION FILMS ON SILICON SOLAR CELLS
R. B. Pettit, C. J. Brinker, and C. S. Ashley 1985 5 p refs Presented at 13th Photovoltaic Concentrator Project Integration Meeting, Albuquerque, N. Mex., 4 Jun. 1985
(Contract DE-AC04-76DP-00789)
(DE85-011280; SAND-85-0936C; CONF-8506140-1) Avail: NTIS HC A02/MF A01

SiO2 and TiO2 sol-gel solutions were prepared for use as antireflection coatings on silicon solar cells. Multiple layers of the sol-gel were applied to silicon substrates, and the resulting reflectance curves were measured and calculated. The reflectance properties double layer coatings on silicon were calculated as a function of the thickness of the SiO2 and TiO2 layers near the optimum range. DOE

N86-11689# Sandia Labs., Albuquerque, N. Mex.
DEVELOPMENT OF MEMBRANES FOR THE ZINC/FERRICYANIDE BATTERY
R. A. Assink and C. Arnold, Jr. 1985 18 p refs Presented at 20th Intersoc. Energy Conversion Eng. Conf., Miami Beach, Fla., 18 Aug. 1985
(Contract DE-AC04-76DP-00789)
(DE85-011189; SAND-84-2358C; CONF-850808-5) Avail: NTIS HC A02/MF A01

The successful commercialization of the zinc/ferricyanide battery depends in part on the availability of an inexpensive, chemically stable membrane. The objectives of this study were to: (1) identify chemically stable commercial and/or developmental membranes, and (2) explore new approaches to the synthesis and fabrication of chemically stable membranes. The stability of membranes was evaluated by their response to a saturated solution of sodium ferricyanide in 5N sodium hydroxide for one week at 50 C. The most promising membranes were tested in cycling test cells by Lockheed Corp. The cycle tests enabled the cell's voltaic, coulombic and energy efficiency to be determined as a function of a membrane's exposure time. A radiatively grafted membrane prepared by RAI Research Corp. using fluorinated film substrates exhibited 79.3% average energy efficiency for 760 charge/discharge cycles. A membrane prepared by casting sulfonated polysulfone exhibited 75.4% average energy efficiency for 150 charge/discharge cycles. DOE

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N86-11690# Oak Ridge National Lab., Tenn.
INTEGRATED FOREST STUDY ON EFFECTS OF ATMOSPHERIC DEPOSITION. PROJECT SUMMARY
D. W. Johnson and S. E. Lindberg Jul. 1985 38 p
(Contract DE-AC05-84OR-21400)
(DE85-015972; DOE/OR-21400/T157) Avail: NTIS HC A03/MF A01

The forest effects research is divided into two major sections: atmospheric deposition and forest nutrient dynamics. Atmospheric deposition tasks will provide estimates of the rates of deposition to the canopy by precipitation, dry deposition of vapors and particles, and by cloud and fog interception, and also the wetfall return to the forest floor. The forest nutrient effects tasks will provide estimates of element fluxes in litter and soil systems,

estimates of internal H(+) production, and characterization of key processes leading to S, N, and H saturation in soils. The results of these tasks will be combined in assessments of atmospheric deposition effects on forest nutrient cycles, which can in turn be applied to assessments of nutritional causes of forest dieback and long-term effects on productivity. DOE

N86-11691# California Univ., Livermore. Lawrence Livermore Lab.
UNCERTAINTIES IN THE RADIATIVE PROPERTIES OF SMOKE AND THEIR EFFECTS ON CLIMATE ASSESSMENTS
F. M. Luther Jul. 1985 13 p refs Presented at the 4th Intern. Conf. on Nucl. War, Erice, Italy, 19 Aug. 1984
(Contract W-7405-eng-48)
(DE85-015187; UCRL-92942; CONF-8408122-6) Avail: NTIS HC A02/MF A01

The sensitivity of the climatic effects of large tropospheric smoke loadings to uncertainties in the physical and radiative properties of the smoke is investigated. The extinction coefficient is shown to be very sensitive to the smoke composition and particle size distribution. The reduction in surface temperature resulting from an initial smoke mass loading of 0.5 gm(-2) varies by more than a factor of depending upon the index of refraction, particle size distribution, and vertical distribution of the smoke in the troposphere. As the smoke is modified by microphysical processes after injection into the atmosphere, the extinction coefficient for urban smoke may be reduced significantly. DOE

N86-11692# Harvard Univ., Cambridge, Mass. Biological Labs.
EFFECT OF ELEVATED ATMOSPHERIC CO2 ON PLANT COMMUNITIES. ANNUAL REPORT, 1984-1985
F. A. Bazzaz 1985 35 p
(Contract DE-FG02-84ER-60257)
(DE85-015575; DOE/ER-60257/1) Avail: NTIS HC A03/MF A01

The effects of elevated CO2 on species relationships were examined by exposing competing groups of plants to high CO2 and analyzing their ecological and physiological responses. Researchers analyzed total community productivity in these groups to learn about which combinations of species and resources show enhanced productivity with increased CO2 and which do not. DOE

N86-11693# California Univ., Livermore. Lawrence Livermore Lab.
STUDY OF HEAVY GAS EFFECTS ON THE ATMOSPHERIC DISPERSION OF DENSE GASES, REVISION 1
D. L. Ermak and S. T. Chan Apr. 1985 25 p refs Presented at 15th Intern. Tech. Survey on Air Pollution Modeling and It's Appl., St. Louis, 15 Apr. 1985
(Contract W-7405-eng-48)
(DE85-012917; UCRL-92494-Rev-1; CONF-8504135-2-Rev-1) Avail: NTIS HC A02/MF A01

In this paper, four different types of dispersion simulations are compared with the results from three heavy gas dispersion experiments. The experiments include two different release gases (LNG vapor, a cold dense gas and NO2, an isothermal dense gas) and three different wind speeds and atmospheric stabilities. The four types of dispersion simulations are a heavy gas simulation, a neutrally buoyant gas simulation, and two types of trace gas simulations. Two models (FEM3 and Steady State SLAB) are used to make the predictions. FEM3 simulates the dispersion of a heavy gas by solving the time dependent, three dimensional conservation equations and uses similarity profiles to determine the crosswind dependence. The purpose of this paper is to demonstrate how the inclusion of heavy gas phenomena and the choice in concentration averaging time affect the concentration prediction from a heavy gas release. DOE

N86-11694# PEI Associates, Inc., Cincinnati, Ohio.
LABORATORY EVALUATION OF THE PROTOCOL FOR THE VOLATILE ORGANIC SAMPLING TRAIN
T. J. Logan, R. G. Fuerst, M. R. Midgett (EPA, Research Triangle Park, N. Car.), and J. Prohaska 1985 17 p refs
(Contract EPA-68-02-3767)
(PB85-201184; EPA-600/D-85-107) Avail: NTIS HC A02/MF A01 CSCL 14B

The measurement of volatile organic emissions from a hazardous waste incinerator is one of the more difficult source testing problems. Specific compounds called Principal Organic Hazardous Constituents (POHC) are to be identified and quantified at levels of 0.5 to 100 ppb in hot, wet incinerator exhaust gas, which may also contain high particulate and acid levels. The protocol, which describes the practices used by laboratories making these measurements, allows for several alternative designs and operating procedures. This paper describes an experimental program to evaluate under controlled conditions in the laboratory as many of the acceptable practices as possible. It describes the results of sampling at various concentration levels using two tube configurations, two moisture levels and other procedural variations. These results have led to conclusions about the specific VOST procedures to be followed during the field validation studies. Author (GRA)

N86-11695# Midwest Research Inst., Kansas City, Mo.
DEVELOP, EVALUATE AND VALIDATE CONTINUOUS EMISSION MONITORS FOR DESIGNATED HAZARDOUS POLLUTANTS Final Report
G. W. Scheil May 1985 75 p
(Contract EPA-68-02-3770)
(PB85-201176; EPA-600/4-85-037) Avail: NTIS HC A03/MF A01 CSCL 14B

The objectives of the project are to assess the state of the art of continuous emission monitoring of vinyl chloride monomer (VCM) and to conduct actual experiments to evaluate two monitors in laboratory and in a six-month field testing program. A process GC with flame ionization detector and a photoionization detector were used during this study. Three one-week EPA Method 106 tests were conducted during the six-month field testing program to measure the relative accuracies of the monitors. The precisions of both types of detectors all were in the 1% range when evaluated in laboratory. The relative accuracies for both types of detectors were < 10% for VCM concentration between 2 to 10 ppm. Author (GRA)

N86-11696# Environmental Protection Agency, Research Triangle Park, N.C. Atmospheric Sciences Research Lab.
REGIONAL-SCALE (1000 KM) MODEL OF PHOTOCHEMICAL AIR POLLUTION. PART 3: TESTS OF THE NUMERICAL ALGORITHMS
R. G. Lamb and G. F. Laniak (Program Resources, Inc.) May 1985 291 p refs
(PB85-203818; EPA-600/3-85-037-Pt-3) Avail: NTIS HC A13/MF A01 CSCL 13B

The Regional Oxidant Model (ROM) developed in two earlier reports is applied to a series of hypothetical problems whose exact solutions are known. Comparisons are made between the model's predictions and the known solutions to assess the accuracies of the numerical algorithms that comprise the models's predictive equations. It is found that in the case of ozone, the solutions of the numerical algorithms on which the model is based are within 10 percent of the solutions of the corresponding differential equations that describe the chemical and physical processes that the model simulates. Extensive documentation is provided in the report of the model's performance in simulating the concentrations of 23 chemical species over a 48 hour period. Author (GRA)

N86-11697# Environmental Protection Agency, Atlanta, Ga.
SALTWATER WETLANDS FOR WASTEWATER MANAGEMENT ENVIRONMENTAL ASSESSMENT
Nov. 1984 322 p
(PB85-201267; EPA-904/10-84-128) Avail: NTIS HC A14/MF A01 CSCL 06F

Saltwater wetlands have the potential for use as municipal and seafood processing wastewater-discharge sites. However, the potential also exists for adversely impacting these important natural resources. The Saltwater Wetlands or Wastewater Management Environmental Assessment is designed to explore the feasibility

of using saltwater wetlands for municipal and seafood processing wastewater management and to identify areas of concern that are important to local, state and federal agencies in making wastewater management decisions affecting saltwater wetlands in the southeastern United States. This assessment is a companion study to the previously initiated Freshwater Wetlands for Wastewater Management Environmental Impact Statement (EIS). The emphasis of this Saltwater Wetlands Environmental Assessment is to provide a description of key saltwater wetland factors, disposal practices and options, regulatory considerations for disposal implementation, and areas where additional wetland research is needed. GRA

N86-11698# Tennessee Water Resources Research Center, Knoxville.
EFFECTS OF ACID PRECIPITATION ON COMPOSITION, ELECTROKINETIC BEHAVIOR, CATION ADSORPTION AND ION EXCHANGE CAPACITY IN VARIOUS SOIL SYSTEMS
A. R. Bowers and T. Higgs Sep. 1984 94 p
(Grant DI-14-08-0001-G-870)
(PB85-217727; RR-103; UT/PUB-R01-2550-29-001-85; USGS/G-870-03) Avail: NTIS HC A05/MF A01 CSCL 08M

The effects of acidic environments on the physical/chemical behavior of natural soils from Tennessee were examined in the laboratory. Primarily, the influence of increased weathering of iron oxides on electrokinetic behavior, cation exchange capacity and adsorption of free and complexed heavy metals was studied. Natural soils, compared to samples in which iron oxides were removed showed little change in cation exchange capacity or electrokinetic behavior. Acid aging of one particular soil was also conducted. Studies showed that prolonged exposure to acidic environments may result in drastic changes in soil properties. Substantial changes in the electrokinetic behavior were found with the zero point of charge increasing from a pH of 2.0 for the unaged soil to 8.0 for the acid aged one. Also, the zinc adsorptive behavior of the soils changed significantly with acid aging. The study indicates that prolonged exposure to acidic environments may create changes in physical/chemical properties of soils rich in iron oxides. GRA

N86-11624*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SPECTRAL CHARACTERIZATION OF SUSPECTED ACID DEPOSITION DAMAGE IN RED SPRUCE (PICEA RUBENS) STANDS FROM VERMONT
James E. Vogelmann and Barrett N. Rock *In its* Proc. of the Airborne Imaging Spectrometer Data Anal. Workshop 15 Jun. 1985 p 51-55 refs ERTS (For primary document see N86-11618 02-43)
Avail: NTIS HC A09/MF A01 CSCL 13B

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N86-11699 Northwestern Univ., Evanston, Ill.
OCEANIC INTRAPLATE SEISMICITY: IMPLICATIONS FOR THE RHEOLOGY AND TECTONICS OF THE OCEAN LITHOSPHERE Ph.D. Thesis
Douglas Alvin Wiens 1985 235 p
Avail: Univ. Microfilms Order No. DA8511877

The strength of the oceanic lithosphere is constrained by the maximum depth of oceanic intraplate seismicity, which increases with lithospheric age and appears to be bounded by a 700 C isotherm. Intraplate earthquake focal mechanisms indicate that older oceanic lithosphere is in compression, models of the stresses produced by a combination of ridge push and basal drag forces require the magnitude of the drag be less than a few bars for rapidly moving plates. Focal mechanisms of intraplate earthquakes in young oceanic lithosphere indicate a diversity of faulting styles. Tensional stress in the spreading direction is concentrated in a very narrow zone at the ridge axis, suggesting the axial region has very little tensile strength. The intraplate seismicity rate is highest in young lithosphere, indicating that stress sources concentrated in young lithosphere are significant. However, most of the near-ridge seismicity occurs in five areas, suggesting local perturbations strongly affect near-ridge seismicity. It is indicated that a deconvolution method is useful for determining the depth, mechanism, source time function and rupture characteristics of an earthquake from P and SH waveforms. This technique is used to determine the source parameters of three large intraplate earthquakes. Dissert. Abstr.

N86-11700*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SAGE AEROSOL MEASUREMENTS. VOLUME 1: FEBRUARY 21, 1979 TO DECEMBER 31, 1979
M. Patrick McCormick Oct. 1985 371 p refs
(NASA-RP-1144; L-15962; NAS 1.61:1144) Avail: NTIS HC A16/MF A01 CSCL 04A

The Stratospheric Aerosol and Gas Experiment (SAGE) satellite system, launched on February 18, 1979, provides profiles of aerosol extinction, ozone concentration, and nitrogen dioxide concentration between about 80 N and 80 S. Zonal averages, separated into sunrise and sunset events, and seasonal averages of the aerosol extinction at 1.00 microns and 0.45 microns ratios of the aerosol extinction to the molecular extinction at 1.00 microns, and ratios of the aerosol extinction at 0.45 microns to the aerosol extinction at 1.00 microns are given. The averages for 1979 are shown in tables and in profile and contour plots (as a function of altitude and latitude). In addition, temperature data provided by the National Oceanic and Atmospheric Administration (NOAA) for the time and location of each SAGE measurement are averaged and shown in a similar format. Typical values of the peak aerosol extinction were 0.0001 to 0.0002 km at 1.00 microns depth values for the 1.00 microns channel varied between 0.001 and 0.002 over all latitudes. Author

N86-11701*# National Aeronautics and Space Administration, Washington, D. C.
BIBLIOGRAPHY OF TERRESTRIAL IMPACT STRUCTURES
Maurice J. Grolier (Geological Survey, Flagstaff, Ariz.) Sep. 1985 532 p
(NASA Order W-13130)
(NASA-TM-87567; NAS 1.15:87567) Avail: NTIS HC A23/MF A01 CSCL 08G

This bibliography lists 105 terrestrial impact structures, of which 12 are proven structures, that is, structures associated with meteorites, and 93 are probable. Of the 93 probable structures, 18 are known to contain rocks with meteoritic components or to be enriched in meteoritic signature-elements, both of which enhance their probability of having originated by impact. Many of the structures investigated in the USSR to date are subsurface features that are completely or partly buried by sedimentary rocks. At least 16 buried impact structures have already been identified in North America and Europe. No proven nor probable submarine impact structure rising above the ocean floor is presently known; none has been found in Antarctica or Greenland. An attempt has been made to cite for each impact structure all literature published prior to mid-1983. The structures are presented in alphabetical order by continent, and their geographic distribution is indicated on a sketch map of each continent in which they occur. They are also listed tables in: (1) alphabetical order, (2) order of increasing latitude, (3) order of decreasing diameter, and (4) order of increasing geologic age. Author

N86-11702 Ceskoslovenska Akademie Ved, Prague. Scientific Information Centre.
GEOPHYSICAL WORKS, 1982, VOLUME 30
1985 277 p refs
Copyright. Avail: Issuing Activity

Volume 30 of Geophysical Works (1982) published by the Geophysical Institute of the Czechoslovak Academy of Sciences (Prague, 1985), contains 13 articles on geophysical topics. They discuss the following: earth crust-mantle boundary, Legendre polynomial applications, macroseismic effects, seismic waves from underground explosions, seismology in Civil Engineering, seismographic readings, deep geomagnetic sounding, numerical solution of ionospheric filtration of ULF waves, ion whistlers in middle latitudes, and the instability of a vortex series. For individual titles, see N86-11703 through N86-11715.

N86-11703# Ceskoslovenska Akademie Ved, Prague. Geophysical Inst.
ON THE GRAVITATIONAL EFFECT OF THE CRUST-MANTLE BOUNDARY IN CENTRAL EUROPE
Vincenc Vyskoch, Miloslav Burda, and Milada Koziskova *In its* Geophys. Works, 1982, Vol. 30 1985 p 9-31 refs (For primary document see N86-11702 02-46)
Avail: Issuing Activity

The correlation between gravity anomalies, elevations above sea level and depths of the crust-mantle boundary in Central Europe are investigated. The results of the correlation analyses are used to estimate the density jump Delta Sigma at the crust-mantle boundary in the Alps and Carpathians. In both cases Delta Sigma <0.2 g/cu cm. It is found that the density inhomogeneities in the lithosphere may compensate each other so that they are not reflected in the anomalous gravity field. This should be taken into account in dealing with the gravitational effects of deep structure and in constructing density models of the lithosphere. Author

N86-11704# Karlova Univ., Prague (Czechoslovakia). Inst. of Geophysics.
ON THE ADDITION THEOREM FOR LEGENDRE POLYNOMIALS c64
Oldrich Novotny *In* Ceskoslovenska Akademie Ved Geophys. Works, 1982, Vol. 30 1985 p 33-45 refs (For primary document see N86-11702 02-46)
Avail: Issuing Activity

The usual proofs of the addition theorem for Legendre polynomials are founded on the theory of spherical functions. Two, principally simple proofs of this theorem, founded on recurrent formulae for Legendre polynomials and associated Legendre functions, are described here. Author

N86-11705# Ceskoslovenska Akademie Ved, Prague.
ATTENUATION OF MACROSEISMIC EFFECTS OF EARTHQUAKES
Dana Prochazkova *In its* Geophys. Works, 1982, Vol. 30 1985 p 47-93 refs (For primary document see N86-11702 02-46)
Avail: Issuing Activity

One of the main tasks of seismology today is to calculate the earthquake hazard at specific localities. The calculation is also based on the detailed description of macroseismic earthquake fields, which may be manifested by their effects in a given locality. One of the parameters used to calculate the hazard is the attenuation of the macroseismic effects of earthquakes. The propagation of macroseismic effects from the earthquake focus depends on the earthquake mechanism, on the one hand, and on the physical properties of the medium through which the seismic waves propagate, on the other. Since the causes of earthquakes and, consequently, also the earthquake mechanisms and physical properties of the medium are not exactly the same in all focal regions, understandably the attenuation of the macroseismic effects of earthquakes will differ from place to place as well. The purpose of this paper is to study the dependences describing the attenuation of the macroseismic effects of earthquakes and to calculate these dependences for the focal regions of Central Europe. Author

N86-11706# Scientific Coal Research Inst., Ostrava (Czechoslovakia).
TRAVEL-TIME AND ITS RESIDUALS FOR THE BLASTS FROM ESCHENLOHE (BAVARIA)
Karel Holub *In* Ceskoslovenska Akademie Ved Geophys. Works, 1982, Vol. 30 1985 p 95-117 refs (For primary document see N86-11702 02-46)
Avail: Issuing Activity

The seismic waves generated by instantaneous blasts in the stone quarry near Eschenlohe (Bavaria), for purposes of deep seismic sounding, were recorded at 9 sites in the Bohemian Massif, including seismic stations Pruhonice (PRU) and Kasperske Hory (KHC). The travel-time curves of the principal wave groups of body waves, recorded during refraction measurements within the distance range Delta = 245-410 km, are described by the following equations: t = 8.10 + Delta/8.27(Pn), t = Delta/5.85(Pg), t = 9.47 + Delta/4.47(Sn) and t = Delta/3.42(Sg). In analyzing the arrival time residuals (O-C(s)) using the experimental data from the seismic stations of PRU and KHC, and seismic wave velocities determined from the travel-time curves of near earthquakes, relatively high negative values were obtained for Pg-waves. Better agreement of the observed and calculated arrival times was achieved, on the one hand, by reinterpretation of first arrivals and on the other hand by using seismic velocities, derived from refraction measurements. Author

N86-11707# Ceskoslovenska Akademie Ved, Prague. Stavebni Geologie.
SEISMOLOGY IN CIVIL ENGINEERING
Arnost Dvorak *In its* Geophys. Works, 1982, Vol. 30 1985 p 103-117 refs (For primary document see N86-11702 02-46)
Avail: Issuing Activity

Properties of soils and rocks exposed to vibrations in the practice of civil engineering are examined. Seismic and dynamic field investigations, determination of seismic and dynamic modulus of elasticity, coefficients of damping and absorption are studied. Seismic effects of blasting and of other sources of vibrations on structures and persons, application of rock-noise and dynamic tests of piles are studied. Author

N86-11708# Ceskoslovenska Akademie Ved, Prague. Geophysical Inst.
SHORT-PERIOD SVSN-4 SEISMOGRAPH
Vladimir Tobyas *In its* Geophys. Works, 1982, Vol. 30 1985 p 119-140 refs (For primary document see N86-11702 02-46)
Avail: Issuing Activity

The procedure for calculating the parameters of a vertical short-period seismometer for an electromagnetic seismograph with galvanometric recording, and for determining the fundamental constants with a non-negligible coupling coefficient is described. A seismograph with a seismometer period of 0.96 s, a galvanometer period of 1.47 s, critical damping of both systems and a coupling coefficient of 0.17 achieves its maximum magnification of 36000 for the period motion of 0.8 s. The equivalent damping constants of 0.61 and 1.43 guarantee quick damping of the transient oscillations of the seismograph. The errors of the mean magnification under long-term operation are estimated on the basis of calculated changes of the constants caused by the changes of the parameters. The seismograph which has been operating at the seismic station of Pruhonice (PRU) for the purposes of the seismic service since 1960, permits extensive material to be collected for studying near as well as distant earthquakes. Author

N86-11709# Slovak Academy of Sciences, Hurbanova (Czechoslovakia). Geophysical Inst.
MAGNIFICATION OF LOW-SENSITIVITY CHANNELS IN SEISMOGRAPHS WITH STANDARD CHARACTERISTICS
Ivan Broucek and Vladimir Tobyas (Ceskoslovenska Akademie Ved., Prague) *In* Ceskoslovenska Akademie Ved Geophys. Works, 1982, Vol. 30 1985 p 141-153 refs (For primary document see N86-11702 02-46)
Avail: Issuing Activity

The accuracy of an approximate method of computing the magnification of the low-sensitivity channel is analyzed on an analog computer for the parameters of seismographs with standard characteristics used in the network of seismic stations of CAPG (Commission of the Academies of Sciences of the Socialist Countries for Planetary Geophysical Research). The errors of the

method of computation depend on the magnitude of the coupling coefficient of the basic channel of the seismograph: for short periods of motion they approach zero and they are usually largest outside the passband in the range of long periods. The error in the magnification of the low-sensitivity channel of a short-period seismograph with an A IV amplitude characteristic and a maximum magnification of the basic channel of 100000 is 65% at the most, of an intermediate-period seismograph with a magnification of 1000 as much as 24%, and of a long-period seismograph with a maximum magnification of 900 up to 19%. Author

N86-11710# Ceskoslovenska Akademie Ved, Prague. Geophysical Inst.

STATISTICAL PROPERTIES OF GEOMAGNETIC PULSATIONS AT THE FUERSTENFELDBRUCK OBSERVATORY DETERMINED BY MEANS OF PULSATION INDICES. PART 3: CORRELATION WITH THE PARAMETERS OF THE INTERPLANETARY MAGNETIC FIELD

Jaroslav Strestik *In its* Geophys. Works, 1982, Vol. 30 1985 p 155-178 refs (For primary document see N86-11702 02-46)

Avail: Issuing Activity

Geomagnetic pulsations recorded at the observatory of Furstenfeldbruck (FRG) in the years 1963 to 1971 were processed in the form of pulsation indices. The correlation of these indices and also of the Ap-amplitudes with the Interplanetary Magnet Field (IMF) parameters is investigated: with the intensity B and its components, with the solar-wind velocity v, with the Alfven velocity V sub a with the particle concentration N, and with the components of the interplanetary electric field E sub y and E sub z. The mean values of the individual indices are determined for different polarities of the IMF components and separately for large and small values of B, v, Ap, etc. Also all the correlations are calculated separately or the above divisions. In conclusion, the mean values of some IMF quantities, corresponding to the values of the indices within certain intervals are given and used to show how the index values and Ap's can be used to estimate the magnitude of some of the IMF parameters. Author

N86-11711# Ceskoslovenska Akademie Ved, Prague. Geophysical Inst.

DETERMINATION OF THE DEPTH OF A CONDUCTIVITY ANOMALY BY SEPARATING THE GEOMAGNETIC VARIATION FIELD INTO ITS EXTERNAL AND INTERNAL PART

Jana Pecova *In its* Geophys. Works, 1982, Vol. 30 1985 p 179-197 refs (For primary document see N86-11702 02-46)

Avail: Issuing Activity

The problem in question is part of deep geomagnetic sounding carried out on a local or regional scale, whose solution requires synchronous records of the variations of the geomagnetic field components along profiles running through the area being investigated. The variation of the geomagnetic field, observed at the Earth's surface, is composed of an external and internal part. The external part represents the magnetic field of current systems in outer space, particularly in the ionosphere. Due to the incidence of corpuscular and wave radiation from the Sun, electrical current systems, which generate a variable magnetic field, are created in the outer conductive layers of the Earth. This variable primary magnetic field also induces systems of electrical currents within the conductive layers of the Earth's interior, which then generate their own secondary variable magnetic field. This secondary magnetic field provides information about the medium in which the induction has taken place and through which the electromagnetic waves propagate. It is referred to as the internal part of the variation field observed at the Earth's surface. In order to determine the properties of the medium, the internal part has to be separated from the external. Author

N86-11712# Foreign Trade Computer Centre, Prague (Czechoslovakia).

NUMERICAL SOLUTION OF IONOSPHERIC FILTRATION OF ULF WAVES. PART 1: METHOD

Vladimir Vagner *In* Ceskoslovenska Akademie Ved Geophys. Works, 1982, Vol. 30 1985 p 199-229 refs (For primary document see N86-11702 02-46)

Avail: Issuing Activity

The algorithm for solving the transmission and reflection of both homogeneous spectral natural wave modes is optimized and programmed in FORTRAN IV. The input of this program are the values of the parameters of the profiles of the ionospheric plasma, the conductivity of the Earth's crust, the dip and values of the outer magnetic induction of the Earth, as well as the values of the ranges of the variable parameters of frequencies and angles of incidence, and the data determining whether the incident mode is electron or ion. Moreover, data can be given which enable the standard spacing densities of both variable parameters to be varied and the transition layer to be discretized. The output, apart from the values of the indicators of accuracy and stability of the computations, are the matrices of the values of the amplitude and energetic real coefficients and of the supplementary energetic coefficients. Some of these characteristics describe the transition layer and document the possibilities of this program. The input parameters are chosen to simulate the situation in the mid geomagnetic latitudes. Author

N86-11713# Ceskoslovenska Akademie Ved, Prague. Geophysical Inst.

NUMERICAL SOLUTION OF IONOSPHERIC FILTRATION OF ULF WAVES. PART 2: APPLICATION

Karel Prikner and Vladimir Vagner (Foreign Trade Computer Centre) *In its* Geophys. Works, 1982, Vol. 30 1985 p 231-257 refs (For primary document see N86-11702 02-46)

Avail: Issuing Activity

The problem of ionospheric correction is still topical from the point of view of micropulsation wave diagnostics of the ionized envelope of the Earth. The micropulsation diagnostics of the magnetosphere make use of natural geomagnetic activity recorded in a network of terrestrial observatories. The material which has so far been recorded, is abundant and, to a considerable extent, also continuous in time and space. However, the available data pertaining to the wave field, recorded at the Earth's surface, do not permit a complete reconstruction of the primary signal above the ionosphere. These data provide us with a number of parameters (amplitudes, phase and polarization characteristics, energy flow, etc.) which enable us to develop methods of modeling various wave-propagation patterns. We are able to evolve a method for eliminating the effect of the ionosphere on the received signal, the method of ionospheric correction. Micropulsations, i.e., ULF signals recorded at the Earth's surface, provide information about the structure and dynamics of the plasma in the magnetosphere which is, however, distorted due to the propagation of electromagnetic (or MHD) waves through the dense layers of the ionosphere. The vertically, strongly inhomogeneous, anisotropic (magnetoactive) ionosphere, in which losses occur, may be interpreted as a stratifed inhomogeneous interference filter which deforms the original signal, generated in the magnetosphere. Author

N86-11714# Ceskoslovenska Akademie Ved, Prague. Geophysical Inst.

ION WHISTLERS IN MIDDLE LATITUDES OBSERVED BY THE INTERKOSMOS-14 SATELLITE

Jaroslava Boskova and Frantisek Jiricek *In its* Geophysical Works, 1982, Vol. 30 1985 p 259-267 refs (For primary document see N86-11702 02-46)

Avail: Issuing Activity

Ion cyclotron whistlers from higher geomagnetic latitudes, as found in the Interkosmos-14 Very Low Frequency (VLF) data set, distinctly reflect the effects of processes in the midlatitude trough of light ions. These proton whistlers indicate a marked decrease of the relative proton content in the vicinity of the satellite with increasing geomagnetic latitude. As it is further shown, proton whistlers from higher geomagnetic latitudes give additional information on some changes of the plasma parameters in the region of midlatitude plasma troughs. They are able to indicate the satellite's crossing of a point with a very steep gradient of the O(+)-H(+) transition height and to provide information on the

plasma structure in the medium below the satellite along the propagation path of ion cyclotron waves. Author

N86-11715# Ceskoslovenska Akademie Ved, Prague. Inst. of the Physics of the Atmosphere.
ON THE INSTABILITY OF VORTEX SERIES c64
Jiri Horak *In its* Geophys. Works, 1982, Vol. 30 1985 p 269-285 refs (For primary document see N86-11702 02-46)
Avail: Issuing Activity

The instability of the vortex motion of an ideal liquid is examined by means of the algebraic physics method and perturbation theory. The instability criterion is based on the hydrodynamic analog of the expression for the second full differential of the kinetic energy of rotation of a rigid body, fixed at a point. Author

N86-11716# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
PLASMAS IN THE EARTH'S MAGNETOTAIL Progress Report
L. A. Frank May 1985 33 p Original contains color illustrations (Contract N00014-76-C-0016)
(AD-A157320; U-OF-IOWA-85-12) Avail: NTIS HC A03/MF A01 CSCL 04/1

An overview of the general characteristics of plasmas within the Earths magnetotail and its environs is presented. Present knowledge of the plasmas within these regions as gained via in situ measurements provides the general theme, although observations of magnetic fields, energetic particles and plasma waves are included in the discussion. Primary plasma regimes in the magnetotail are the plasma sheet, its boundary layer, the magnetotail lobes, the boundary layer at the magnetopause and the distant magnetotail. Although the great progress in our understanding of these regions is evident in the literature of the past several years, many of their features remain as exciting enigmas to be resolved by future observational and theoretical investigation. GRA

N86-11717# Naval Research Lab., Washington, D. C.
MEASUREMENTS OF REFRACTIVE INDEX STRUCTURE FUNCTION C2N AND AEROSOL SIZE DISTRIBUTION AT CHESAPEAKE BAY Memorandum Report, Oct. 1982 - Oct. 1983
D. R. Cutten 26 Jul. 1985 36 p
(AD-A157455; NRL-MR-5593) Avail: NTIS HC A03/MF A01 CSCL 04/1

Measurements of (C sub N) square using fine wire thermal probes were obtained on a 35 m tower located between the cliff face and the shoreline at Chesapeake Bay, MD. The data collected have shown, using long averaging times, that the -4/3 height dependence of (C sub N) generally still applies in the vicinity of the cliff face with light winds coming from either over the cliff or over the water. The aerosol size distribution data revealed very little change in the distribution with height. Over the 0.15 to 0.75 micrometers radius range both bi-modal log-normal and power laws described the shape of the distribution curves. Author (GRA)

N86-11718# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
PERIGLACIAL LANDFORMS AND PROCESSES IN THE SOUTHERN KENAI MOUNTAINS, ALASKA Special Report
P. K. Bailey Apr. 1985 72 p
(AD-A157459; CRREL-SR-85-3) Avail: NTIS HC A04/MF A01 CSCL 08/12

The distribution and characteristics of periglacial landforms in the southern Kenai Mountains, Alaska, were investigated during 1979 and 1980. The principal area of study was a 1300-m-high mountain mass that stood as a nunatak during the last general glaciation. Periglacial features in the area include gelifluction lobes, nivation hollows, cryoplanation terraces, tors, a string bog, and such patterned ground as sorted circles, sorted polygons, earth hummocks, sorted steps, sorted stripes, and small ice-wedge polygons. Ground temperature measurements indicate that permafrost exists in only isolated patches but may have recently been much more extensive. The sorted polygons, cryoplanation terraces, and nivation hollows are relict features that have been inactive for a considerable time. The turf-banked sorted steps and large gelifluction lobes probably were active until the recent thawing of permafrost. Cryofraction and frost sorting still are vigorous, active progresses. Finely jointed bedrock, a previous colder environment, and long exposure in the absence of glacial ice has allowed periglacial processes to be the dominant surface agents both in the principal study area and in similar areas along the western side of the Kenai Mountains. GRA

N86-11719# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
WORKSHOP ON PERMAFROST GEOPHYSICS Special Report
J. Brown, M. C. Metz, and P. Hoekstra May 1985 124 p Workshop held at Golden, Colo., 23-24 Oct. 1984 Prepared in cooperation with National Academa of Sciences/National Research Council (AD-A157485; CRREL-SR-85-5) Avail: NTIS HC A06/MF A01 CSCL 08/12

This report contains abstracts and summary papers of presentations made at a workshop in October 1984. Major topics include: deep onshore and offshore permafrost methods; shallow geophysical and borehole methods; and shallow geophysical methods and terrain analysis. GRA

N86-11720# Los Alamos National Lab., N. Mex.
SUBSURFACE GEOLOGY OF THE PAJARITO PLATEAU, ESPANCIA BASIN, NEW MEXICO
B. J. Dransfield and J. N. Gardner May 1985 23 p refs
(Contract W-7405-eng-36)
(DE85-016215; LA-10455-MS) Avail: NTIS HC A02/MF A01

Integration of data from wells, geophysical surveys, and surface exposures has enabled construction of structure contour and paleogeologic maps of the pre-Bandelier Tuff surface beneath the Pajarito Plateau. Numerous faults of the Rio Grande rift system cut the pre-Bandelier Tuff surface, and most have down-to-the-west displacements. Cumulative down-to-the-west movements across these faults from the Rio Grande on the east to the Rendija Canyon fault zone on the west exceed 600 ft (185 m). All faults in the area show evidence of recurrent activity, with increasing displacements of progressively older rock units. The southern Pajarito fault zone has over 600 ft (185 m) of pre-Bandelier Tuff down-to-the-east movement. The Pajarito fault zone and a major pre-Bandelier Tuff fault identified herein may constitute the local boundaries of the southern continuation of the intra-rift Velarde graben. The paleogeologic map shows that three major rock units (Cerros del Rio basalts, Tschicoma Formation dacites, and Puye Formation gravels) underlie the Bandelier Tuff and interfinger beneath the central Pajarito Plateau. DOE

N86-11721# Texas A&M Univ., College Station. Center for Tectonophysics.
DEFORMATION OF GRANITE AT ELEVATED TEMPERATURE AND PRESSURE Final Report, 1 Mar. 1984 - 28 Feb. 1985
N. I. Carter 15 Mar. 1985 21 p refs
(Contract DE-FG05-84ER-13216)
(DE85-014057; DOE/ER-13216/T1) Avail: NTIS HC A02/MF A01

The purpose was to determine the evolution of substructure and mechanical behavior of westerly granite, deformed under both wet and dry conditions, from the initial stages of transient creep well into the steady-state. Following calibration of the 10 kb gas apparatus at elevated temperature and pressure, the main pressure vessel burst. As a consequence, other studies were pursued. These include: (1) analysis of olivine fabrics of ophiolites; (2) upper mantle deformation in collision zones; (3) flow properties of continental lithosphere; and (4) mechanical behavior of oceanic layer 2 basalts. DOE

N86-11722# California Univ., Berkeley. Lawrence Berkeley Lab.
ELECTROMAGNETIC SOUNDINGS FOR GEOTHERMAL RESOURCES IN DIXIE VALLEY, NEVADA
M. J. Wilt and N. E. Goldstein Mar. 1985 8 p refs Presented at Intern. Symp. on Geothermal Energy, Kailua Kona, Hawaii, 26 Aug. 1985
(Contract DE-AC03-76SF-00098)

(DE85-011986; LBL-19321; CONF-850801-35) Avail: NTIS HC A02/MF A01

An electromagnetic (EM) sounding survey was performed over a region encompassing the Dixie Valley geothermal field to map the subsurface resistivity in the geothermal field and the surrounding area. The EM survey, consisting of 19 frequency domain depth soundings made with the LBL EM-60 system, was undertaken to explore a narrow region adjacent to the Stillwater Range to a depth of 2 to 3 km. Lithologic and well log resistivity information from well 66-21 show that for EM interpretation the section can be reduced to a three layer model consisting of moderately resistive alluvial sediments, low resistivity lacustrine sediments, and high resistivity Tertiary volcanics and older rocks. This three layer model was used as a starting point in interpreting EM sounding data. Variations in resistivity and thickness provided structural information and clues to the accumulation of geothermal fluids. The interpreted soundings reveal a 1 to 1.5 km deep low resistivity zone spatially associated with the geothermal field. The shallow depth suggests that the zone detected is either fluid leakage or hydrothermal alteration, rather that high temperature reservoir fluids. DOE

N86-11723# National Oceanic and Atmospheric Administration, Silver Spring, Md. Air Resources Labs.

LIDAR OBSERVATIONS OF STRATOSPHERIC AEROSOL OVER MAUNA LOA OBSERVATORY: 1982 - 1983

J. DeLuisi, T. Defoor, K. Coulson, and F. Fernald Feb. 1985 85 p ref

(PB85-187896; NOAA-DR-ERL-ARL-5) Avail: NTIS HC A05/MF A01 CSCL 04A

One hundred and nine lidar profiles obtained during the years 1982 to 1983, are presented. Backscattering ratios are displayed in graphical form for 1-km intervals. Aerosol backscattering cross section, Rayleigh backscattering cross section, backscattering ratio and integrated optical thickness are tabulated, also for 1-km intervals. Two significant episodes of stratospheric aerosol were detected in 1982. A mystery aerosol cloud was detected on the 28th of January and the immense aerosol cloud from El Chichon was detected on the 9th of April. Some additional analysis of the lidar data is given in this report. A plot of stratospheric aerosol optical thickness above 15 km for 1974 to 1983, inclusively, is given. These tables should be useful for modeling climatic effects of El Chichon. Author (GRA)

N86-11724# National Oceanic and Atmospheric Administration, Boulder, Colo. Space Environment Lab.

TIROS/NOAA (TELEVISION AND INFRARED OBSERVATION SATELLITE/NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION) SATELLITES SPACE ENVIRONMENT MONITOR ARCHIVE TAPE DOCUMENTATION

V. J. Hill, D. S. Evans, and H. H. Sauer Jan. 1985 56 p refs

(PB85-187920; NOAA-TM-34L-SEL-71) Avail: NTIS HC A03/MF A01 CSCL 04A

TIROS/NOAA satellite archive tapes containing data obtained with the Medium Energy Proton and Electron Detector (MEPED), High Energy Proton and Alpha Particle Detector (HEPAD), and Total Energy Detector (TED) are described. Descriptions of the data include orbital and housekeeping details and the information needed to decode and understand the data. Specifications of the data channels are supplied, with the timing information needed to convert the data to usable information. Description of the archive tape format gives the information needed to read the tape and unpack the data. Appendices supply the retrieval routines used by the Space Environment Services Center in Boulder. Author (GRA)

N86-11725# University of Southern California, Los Angeles. Geophysics Lab.

EARTHQUAKE HAZARD RESEARCH IN THE LOS ANGELES BASIN AND ITS OFFSHORE AREA, OCTOBER 1, 1983 TO SEPTEMBER 30, 1984

E. Hauksson, T. Teng, T. L. Henyey, J. K. McRaney, and L. Hsu Mar. 1985 44 p refs

(Contract DI-14-08-0001-21858)

(PB85-196491; TR-85-1) Avail: NTIS HC A03/MF A01 CSCL 08K

The Geophysics Laboratory at the University of Southern California is conducting a comprehensive investigation of seismicity in the greater Los Angeles basin and its offshore area under U.S.G.S. Contract No. 14-08-0001-21858. As a part of this investigation, U.S.C. operates a seismic network in the Los Angeles basin area. During the 1984 fiscal year the authors have concentrated on seismotectonic analysis of the seismicity recorded in the Los Angeles Basin during the last 10 years. A comprehensive study of earthquakes along the Newport-Inglewood fault is in progress and the authors report the latest results. The authors are also reanalyzing the January 1, 1979 Malibu earthquake and its aftershocks. Author (GRA)

N86-11726# University of Southern California, Los Angeles. Geophysics Lab.

DEEPWELL MONITORING ALONG THE SOUTHERN SAN ANDREAS FAULT

T. L. Henyey and S. P. Lund Mar. 1985 25 p refs

(Contract DI-14-08-0001-21879)

(PB85-196483; TR-85-3) Avail: NTIS HC A02/MF A01 CSCL 08K

Reports of strain-related changes in groundwater level flow rate, chemistry, and even turbidity accompanying large seismic events are widespread in the earthquake literature. The possibility that similar pre-seismic strains may act on groundwater basins or aquifers near the San Andreas fault cannot be ruled out, even though regional dilatancy may in fact not exist. Although flow rates in aquifers are relatively slow, the pressure response of large aquifers or even basement rocks (with interconnected fracture porosity) to changes in strain should be considerably faster. This is borne out by observation of water level changes due to solid-Earth-tides and the passage of seismic surface waves from local or even teleseismic events. In such cases, appreciable flow is not required for changes of millimeters to decameters in the apparent water tables. The authors reclaimed a set of abandoned deep wells along the San Andrea fault in the Palmdale region in order to monitor groundwater level and temperature variations that might be related to strain changes along the fault. GRA

N86-11727# National Academy of Sciences - National Research Council, Washington, D. C.

POLAR RESEARCH BOARD ANNUAL REPORT 1984 AND FUTURE PLANS Annual Report, Jan. - Dec. 1984

1985 64 p

(PB85-204477) Avail: NTIS HC A04/MF A01 CSCL 08G

The report describes studies completed and work in progress during 1984, and projects planned for initiation in 1985. The report also describes international activities related to the Board's role as U.S. National Committee for the Scientific Committee on Antarctic Research of the International Council of Scientific Unions. Attachments provide lists of names and addresses of Board members and participants in Board special studies, as well as of reports published, in press, and in preparation. Author (GRA)

N86-11728# Environmental Protection Agency, Research Triangle Park, N.C. Atmospheric Sciences Research Lab.

REGIONAL OXIDANT MODELING OF THE NORTHEAST US

K. L. Schere and J. H. Novak 1985 16 p refs

(PB85-201192; EPA-600/D-85-110) Avail: NTIS HC A02/MF A01 CSCL 04A

The occurrence of long range and interurban transport of ozone and/or ozone precursors across the Northeast U.S. has been documented by numerous field studies during the last ten years. The U.S. Environmental Protection Agency initiated the Northeast Corridor Regional Modeling Project (NECRMP) during the late 1970's, in part, to develop a regional model capable of simulating regional transport of ozone and its precursors on scales on the order of 1000 km. The resulting Regional Oxidant Model (ROM) is being applied to the Northeast U.S. to evaluate the effectiveness of various control strategies for reducing ozone in this region.

This paper summarizes the physical processes encompassed by the model including several that have heretofore been omitted from air quality models on smaller scales, such as cumulus cloud effects on vertical atmospheric motions and nighttime wind shear. GRA

N86-11729# National Oceanic and Atmospheric Administration, Washington, D. C.
HIGH ALTITUDE MEASURED RADIANCE OF WHITE SANDS, NEW MEXICO IN THE 400-2000 nm BAND USING A FILTER WEDGE SPECTROMETER
G. R. Smith and R. H. Levin Apr. 1985 25 p refs
(PB85-206084; NOAA-TR-NESDIS-21) Avail: NTIS HC A02/MF A01 CSCL 04A

Activity by the National Oceanic and Atmospheric Administration (NOAA) at White Sands, New Mexico, was directed at providing visible wavelength calibration of Earth oriented satellite instruments. A Filter Wedge Spectrometer (FWS) was flown in an aircraft at an altitude of 11.28 km. The FWS viewed the Earth in a vector parallel to that of the Visible Spin Scan Radiometer (VISSR) satellite aboard a geostationary satellite, and data was taken near solar noon. Samples of FWS Sands radiance from June and September 1981 are presented. Author (GRA)

N86-11730# Environmental Protection Agency, Research Triangle Park, N.C. Atmospheric Sciences Research Lab.
PARAMETERIZATION OF THE ATMOSPHERIC BOUNDARY LAYER FOR AIR POLLUTION DISPERSION MODELS
A. A. M. Holtslag, S. E. Gryning, J. S. Irwin, and B. Sivertsen 1985 31 p refs
(PB85-193548; EPA-600/D-85-095) Avail: NTIS HC A03/MF A01 CSCL 04A

The characteristic features of the turbulent atmospheric boundary layer (ABL) are reviewed by means of scaling arguments. The goal was to characterize the meteorological conditions affecting diffusion for transport on the order of 10 km or less. The idealized ABL is divided into a number of regions, each characterized by distinct scaling parameters for the turbulence. With these scaling parameters wind and vertical dispersion are parameterized. The lateral dispersion is treated separately. Methods are suggested for estimating the surface fluxes of heat and momentum, and the mixing height. Several of the models characterize directly the crosswind integrated concentration at the surface, thus avoiding whenever justified the assumption of a Gaussian distribution of material in the vertical. Author (GRA)

N86-11557# Zagreb Univ. (Yugoslavia). Geodetic Faculty.
ANEW ABOUT THE CORRELATION BETWEEN MOHOROVICIC DISCONTINUITY DEPTHS, GEOID UNDULATIONS AND BOUGUER GRAVITY ANOMALIES IN THE DINARIC-PANNONIAN REGION OF YUGOSLAVIA
K. Colic, S. Petrovic, and T. Basic *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth 1985 p 68-76 refs (For primary document see N86-11549 02-42)
Avail: NTIS HC A09/MF A01

N86-11559# Academy of Sciences, Potsdam (East Germany). Zentralinst. fuer Physik der Erde.
SOME RESULTS OF AN EIGHT YEARS GRAVIMETRIC REGISTRATION SERIES
H.-J. Dittfeld *In its* Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth 1985 p 82-91 refs (For primary document see N86-11549 02-42)
Avail: NTIS HC A09/MF A01

N86-11560# Deutsches Geodaetisches Forschungsinstitut, Munich (West Germany).
GEOPHYSICAL INTERPRETATION OF GLOBAL GEOID UNDULATIONS AND MEAN GRAVITY ANOMALIES
Hermann Drewes *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth 1985 p 95-104 refs (For primary document see N86-11549 02-42)
Avail: NTIS HC A09/MF A01

N86-11564# Technische Hochschule, Darmstadt (West Germany). Inst. fuer Physikalische Geodaesie.
ON THE DISTRIBUTION OF THE RESIDUAL VECTORS OF EARTH'S TIDE GRAVITY OBSERVATIONS IN CENTRAL EUROPE
C. Gerstenecker and P. Varga (Budapest Science Univ.) *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth 1985 p 150-165 refs (For primary document see N86-11549 02-42)
Avail: NTIS HC A09/MF A01

N86-11565# Academia Sinica, Beijing (China). Inst. of Geodesy and Geophysics.
ON THE LUNAR TIDAL EFFECT IN THE LATITUDE OBSERVATIONS AT TIANJIN
Tianqi Han, Yiming Qian, Shiguang Li, and Lanzhen Ma *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth 1985 p 166-168 refs (For primary document see N86-11549 02-42)
Avail: NTIS HC A09/MF A01

N86-11566# Slovak Technical Univ., Bratislava (Czechoslovakia). Observatory.
SOME SHORT PERIODIC TERMS DUE TO NUTATION AND TIDES FROM LATITUDE AND TIME DETERMINATIONS AT CZECHOSLOVAK OBSERVATORIES
Jan Hefty *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth 1985 p 169-172 refs (For primary document see N86-11549 02-42)
Avail: NTIS HC A09/MF A01

N86-11572# Academy of Sciences, Potsdam (East Germany). Zentralinst. fuer Physik der Erde.
ON THE INFLUENCE OF COUPLING TORQUES BETWEEN THE EARTH'S CORE AND MANTLE ON PARAMETERS AND COMPONENTS OF THE ROTATION OF THE EARTH
H. Jochmann *In its* Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 2 1985 p 29-31 refs (For primary document see N86-11568 02-42)
Avail: NTIS HC A09/MF A01

N86-11578# Academia Sinica, Beijing (China). Inst. of Geodesy and Geophysics.
RESEARCH ON THE COMPUTATIONAL METHODS OF GRAVITY TOPOGRAPHIC EFFECT
Jiachun Meng *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 2 1985 p 70-77 refs (For primary document see N86-11568 02-42)
Avail: NTIS HC A09/MF A01

N86-11579# Academy of Sciences (USSR), Moscow.
THE POTENTIALOGRAPHICAL PROBLEM AND THE CONCEPTION OF GRAVITATING DISKS
G. A. Meshcheryakov *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 2 1985 p 78-87 refs In RUSSIAN; ENGLISH summary (For primary document see N86-11568 02-42)
Avail: NTIS HC A09/MF A01

N86-11582# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Geodesy.
ON THE CONVERGENCE PROBLEM OF THE SATELLITE DERIVED SPHERICAL HARMONIC EXPANSION OF THE GEOPOTENTIAL AT THE EARTH'S SURFACE
Lars E. Sjoeberg *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 2 1985 p 108-114 refs (For primary document see N86-11568 02-42)
Avail: NTIS HC A09/MF A01

N86-11586# Geodetic Inst., Charlottenlund (Denmark).
ON THE LONG-WAVELENGTH CORRELATION BETWEEN GRAVITY AND TOPOGRAPHY

C. C. Tscherning *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 2 1985 p 134-143 refs (For primary document see N86-11568 02-42)
Avail: NTIS HC A09/MF A01

N86-11589# Academy of Sciences of the Ukrainian SSR, Kiev (USSR). Astronomical Observatory.
ON REDUCING THE EFFECT OF HORIZONTAL DISPLACEMENTS OF THE LITHOSPHERIC PLATES FROM THE OBSERVATIONS CARRIED OUT BY GLOBAL GEODYNAMIC NETWORK (ON EXAMPLE THE GEOSS-REA NETWORK)
Ya. S. Yatskiv and N. T. Mironov *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 2 1985 p 150-155 refs In RUSSIAN. ENGLISH summary (For primary document see N86-11568 02-42)
Avail: NTIS HC A09/MF A01

N86-11590# Kiel Univ. (West Germany). Inst. of Geophysics.
ANELASTICITY IN THE EARTH'S MANTLE: IMPLICATIONS FOR THE FREQUENCY DEPENDENCE OF LOVE NUMBERS
J. Zschau *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 2 1985 p 160 (For primary document see N86-11568 02-42)
Avail: NTIS HC A09/MF A01

N86-11592# Research Inst. of Geodesy, Topography and Cartography, Prague (Czechoslovakia).
CRCM AND KAPG ACTIVITY IN RECENT CRUSTAL MOVEMENT STUDIES
Pavel Vyskocil *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 4-6 refs (For primary document see N86-11591 02-42)
Avail: NTIS HC A08/MF A01

N86-11593# Mezoegazdasagi es Elelmezesuegyi Ministerium, Budapest (Hungary). Orszagos Foldugyi es Terkepeszeti Hivatal.
ON THE WORKS AND RESULTS OF INVESTIGATIONS CONCERNING THE RECENT MOVEMENTS IN THE KARPATHO-BALKAN REGION
I. Joo *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 7-15 refs In GERMAN; ENGLISH summary (For primary document see N86-11591 02-42)
Avail: NTIS HC A08/MF A01

N86-11594# Niedersaechsisches Landesverwaltungsamt, Hanover (West Germany). Abt. Landesvermessung.
NORTH SEA COAST LEVELLING NET: A MODEL CASE FOR THE DETERMINATION OF VERTICAL MOVEMENTS IN WESTERN EUROPE
Wolfgang Augath and Hans Pelzer (Hannover Univ.) *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 16-25 refs (For primary document see N86-11591 02-42)
Avail: NTIS HC A08/MF A01

N86-11596# Academy of Sciences, Potsdam (East Germany). Zentralinst. fuer Physik der Erde.
GEOKINEMATIC MODELS FOR THE GRAVIMETRIC W - E PROFILE OF THE GDR
W. Conrad, C. Elstner, G. Schwab, W. Schwahn, and S. Thomaschewski *In its* Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 32-43 refs (For primary document see N86-11591 02-42)
Avail: NTIS HC A08/MF A01

N86-11597# Hungarian Academy of Sciences, Sopron. Geodetical and Geophysical Research Inst.
MATHEMATICAL TREATMENT OF VERTICAL MOVEMENTS
J. Czompo *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 44-50 refs (For primary document see N86-11591 02-42)
Avail: NTIS HC A08/MF A01

N86-11598# Technische Univ., Dresden (East Germany). Sektion Geodaesie und Kartographie.
GEODIMETER NET FOR THE INVESTIGATION OF HORIZONTAL CRUSTAL DEFORMATIONS [GEODIMETER-NETZ ZUR UNTERSUCHUNG HORIZONTALER KRUSTENDEFORMATIONEN]
Marion Dost and Guenter Lorenz *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 51-54 refs In GERMAN; ENGLISH summary (For primary document see N86-11591 02-42)
Avail: NTIS HC A08/MF A01

N86-11599# Uppsala Univ. (Sweden). Dept. of Geodesy.
GAUSSIAN AND MEAN CURVATURES OF POSTGLACIAL LAND UPLIFT AS EXPANDED IN SURFACE SPHERICAL HARMONICS, AND THE ORIGIN OF EARTHQUAKES IN FENNOSCANDIA
Martin Ekman *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 55-70 refs (For primary document see N86-11591 02-42)
Avail: NTIS HC A08/MF A01

N86-11600# Academy of Sciences (USSR), Moscow. Inst. of Physics of the Earth.
NEAR-SURFACE DEFORMATIONS AND STRESSES IN THE AREA OF THE TOLBACHIK GREAT FISSURE ERUPTION OF 1975-1976 (KAMCHATKA) FROM GEODETIC DATA
S. V. Enman *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 71-75 refs (For primary document see N86-11591 02-42)
Avail: NTIS HC A08/MF A01

N86-11601# Mezoegazdasagi es Elelmezesuegyi Ministerium, Budapest (Hungary). Orszagos Foldugyi es Terkepeszeti Hivatal.
METHOD OF JOINT ADJUSTMENT OF HEIGHT DIFFERENCES AND VELOCITIES
M. Fury, J. Gergely (Foldmeresi Intezet, Budapest), and Zs. Nemeth (Foldmeresi Intezet, Budapest) *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 76-78 refs (For primary document see N86-11591 02-42)
Avail: NTIS HC A08/MF A01

N86-11602# Mezoegazdasagi es Elelmezesuegyi Ministerium, Budapest (Hungary). Orszagos Foldugyi es Terkepeszeti Hivatal.
PRINCIPLE OF THE CONSTRUCTION OF THE LINES OF THE REPEATED LEVELLING FOR THE INVESTIGATION OF THE VERTICAL MOVEMENT IN THE CARPATHO-BALKAN REGION (CBR)
M. Fury, J. Gergely (Foldmeresi Intezet, Budapest), and Zs. Nemeth (Foldmeresi Intezet, Budapest) *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 79-83 refs In GERMAN; ENGLISH summary (For primary document see N86-11591 02-42)
Avail: NTIS HC A08/MF A01

N86-11603# Bulgarian Academy of Science, Sofia. Central Lab. for Geodesy.
SOME GEODETIC ASPECTS OF THE PROBLEM OF CHECKING THE PLATE-TECTONIC MODEL OF SEISMICITY IN SOUTH-EASTERN EUROPE
N. I. Georgiev, I. N. Totomanov, and C. G. Darakciev *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 84-89 refs (For primary document see N86-11591 02-42)
Avail: NTIS HC A08/MF A01

N86-11604# Eidgenoessische Landestopographie, Bern (Switzerland).
RECENT CRUSTAL MOVEMENTS AND GEOPHYSICAL INTERPRETATION OF GEODYNAMIC PROCESSES IN THE ALPINE MOUNTAIN BELT
E. Gubler and H.-G. Kahle (Eidgenoessische Technische Hochschule, Zurich) *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 90-97 refs (For primary document see N86-11591 02-42)
Avail: NTIS HC A08/MF A01

N86-11605# Karlova Univ., Prague (Czechoslovakia).
DETERMINATION OF CRUSTAL MOVEMENTS IN THE HIGH TATRA MOUNTAINS
L. Hradilek *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 98-99 refs (For primary document see N86-11591 02-42)
Avail: NTIS HC A08/MF A01

N86-11606# Geodetic Inst., Helsinki (Finland).
FINNISH MEASUREMENTS OF THE FENNOSCANDIAN LAND UPLIFT GRAVITY LINES IN FINLAND 1966-1984
Aimo Kiviniemi *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 100-102 refs (For primary document see N86-11591 02-42)
Avail: NTIS HC A08/MF A01

N86-11607# Technische Univ., Dresden (East Germany).
STATIONARY HYDROSTATIC PRECISION TILTMETER SYSTEM [STATIONAERES HYDROSTATISCHES PRAEZISIONS-NEIGUNGSMESSSYSTEM]
G. Lorenz *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 102-105 refs In GERMAN; ENGLISH summary (For primary document see N86-11591 02-42)
Avail: NTIS HC A09/MF A01

N86-11608# Karlsruhe Univ. (West Germany). Geodetic Inst.
HEIGHT CHANGES AND RECENT CRUSTAL MOVEMENTS IN THE RHENISH MASSIF AND IN THE UPPER RHINE GRABEN RIFT
H. Maelzer *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 105-112 refs (For primary document see N86-11591 02-42)
Avail: NTIS HC A08/MF A01

N86-11609# Academy of Sciences (USSR), Moscow. Inst. of Physics of the Earth.
RECENT VERTICAL CRUSTAL MOVEMENTS OF THE CARPATHIAN-BALKAN REGION AND THEIR RELATIONSHIP WITH NEOTECTONIC MOVEMENTS AND GEOPHYSICAL FIELDS
V. A. Magnitsky, A. F. Grachev, I. V. Kalashnikova, and V. V. Bronguleev *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 113-123 refs (For primary document see N86-11591 02-42)
Avail: NTIS HC A08/MF A01

N86-11610# Academy of Sciences (USSR), Moscow.
ON THE RELATION BETWEEN RECENT CRUSTAL MOVEMENTS, THE SURFACE OF THE BASEMENT COMPLEX AND NEOTECTONIC DISPLACEMENTS OF THE EAST-EUROPEAN PLATFORM
V. A. Magnitsky, A. F. Grachev, I. V. Kalashnikova, and V. V. Bronguleev *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 124-130 refs (For primary document see N86-11591 02-42)
Avail: NTIS HC A08/MF A01

N86-11611# Technische Univ., Dresden (East Germany).
SIGNIFICANCE TESTS OF RECENT VERTICAL CRUSTAL MOVEMENTS BY CORRELATION FUNCTIONS Abstract Only
S. Meier *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 131 (For primary document see N86-11591 02-42)
Avail: NTIS HC A08/MF A01

N86-11612# Geodetic Inst., Helsinki (Finland).
COMPARISONS OF DIFFERENT OBSERVATION METHODS OF A LACOSTE AND ROMBERG G GRAVIMETER
Leena Mikkola *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 132-135 refs (For primary document see N86-11591 02-42)
Avail: NTIS HC A08/MF A01

N86-11613# Bulgarian Academy of Science, Sofia. Lab. for Geotechnics.
STATISTICAL ANALYSIS AND INTERPRETATION OF EARTH CRUSTAL MOVEMENTS IN NORTHEAST BULGARIA [STATISTISCHE ANALYSE UND INTERPRETATION DER ERDKRUSTEN-BEWEGUNGEN IN NORDOSTBULGARIEN]
G. Milev and I. N. Totomanov *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 136-139 refs (For primary document see N86-11591 02-42)
Avail: NTIS HC A08/MF A01

N86-11615# Bulgarian Academy of Science, Sofia. Central Lab. for Geodesy.
RELATION BETWEEN EARTHQUAKE FOCAL INTENSITY AND RECENT VERTICAL EARTH'S CRUSTAL MOVEMENTS IN THE RILA-RHODOPE SEISMIC REGION
Ivan N. Totomanov *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 148-155 refs (For primary document see N86-11591 02-42)
Avail: NTIS HC A08/MF A01

N86-11616# Research Inst. of Geodesy, Topography and Cartography, Prague (Czechoslovakia).
DYNAMICS OF THE BOHEMIAN MASSIF
Pavel Vyskocil *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 156-159 refs (For primary document see N86-11591 02-42)
Avail: NTIS HC A08/MF A01

N86-11617# Academy of Sciences, Potsdam (East Germany). Zentralinst. fuer Physik der Erde.
AN OPTIMUM USE OF SEA-LEVEL RECORDINGS
H. Weise *In its* Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 3 1985 p 160-168 refs (For primary document see N86-11591 02-42)
Avail: NTIS HC A06/MF A01

N86-11619*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
MINERALOGICAL MAPPING IN THE CUPRITE MINING DISTRICT, NEVADA
Alexander F. H. Goetz and Vinay Srivastava *In its* Proc. of the Airborne Imaging Spectrometer Data Anal. Workshop 15 Jun. 1985 p 22-31 refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS (For primary document see N86-11618 02-43)
Avail: NTIS HC A09/MF A01 CSCL 08G

N86-11635*# Brown Univ., Providence, R. I. Dept. of Geological Sciences.
SPECTROSCOPY OF MOSES ROCK KIMBERLITE DIATREME
Carle M. Pieters and John F. Mustard *In* JPL Proc. of the Airborne Imaging Spectrometer Data Anal. Workshop 15 Jun. 1985 p 106-110 refs ERTS (For primary document see N86-11618 02-43)
Avail: NTIS HC A09/MF A01 CSCL 08G

N86-11872# Los Alamos National Lab., N. Mex. Advanced Engineering Technology Group.
GEOLOGICAL CALCULATIONS WITH SANGRE AND MANTLE: RECENT RESULTS Abstract Only
Lucy M. Carruthers, Peggy Goldman, and Charles A. Anderson *In its* 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 26 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N86-11731 State Univ. of New York, Stony Brook.
CLIMATE SIMULATION AND CHANGE: A SIMPLE ENERGY BALANCE CLIMATE MODEL Ph.D. Thesis
Steven Donald Goldenberg 1984 212 p
Avail: Univ. Microfilms Order No. DA8512714

Model results are calculated for the Northern Hemisphere for nine 10 latitude zones at one month intervals. The energy balance flux equations are solved separately for open ocean, land and sea ice surface types coupled by an intra-zonal advection term. Meridional transport is via a Budyko-type parameterization, while total net outgoing IR flux is based on a linear, empirical expression. Realistic values for ocean, land, and ice albedo dependent on surface type, surface temperature, cloud fraction and solar zenith angle are used. A diffuse ocean-atmosphere subsurface heating term is used, and a simple physical model of ice freezing and melting provide the subsurface heating flux for sea ice, allowing calculation of ice thickness. With a minimum of tuning, the model accurately predicts the land and ocean seasonal temperature cycles. Model calculated temperatures show a phase lead of about 1 month relative to the observed, a situation linked to the choice of subsurface heating and intra-zonal advection parameterization. Ice thickness results are consistent with observation. Author

N86-11732 Harvard Univ., Cambridge, Mass.
THE EFFECT OF THE HADLEY CIRCULATION ON THE MERIDIONAL PROPAGATION OF STATIONARY WAVES Ph.D. Thesis
Ian Geoffrey Watterson 1985 226 p
Avail: Univ. Microfilms Order No. DA8510227

The effect on the meridional propagation of stationary planetary waves of the inclusion of the zonal mean Hadley circulation in linearized models of the atmosphere is examined. Previous models in which the Hadley circulation was ignored have not been consistent with apparent midlatitude response to tropical forcing since the easterly winds near the equator do not support meridionally propagating waves. The inclusion of a meridional wind in the basic state of a baratropic model enables wave propagation from one midlatitude through the easterlies to the other provided the wind is in that direction. Waves traveling in the other direction can be turned around by the opposing wind. These effects are shown to be consistent with the Wentzel-Kramer-Brillouin method (WKB). The zero zonal wind latitude no longer has significance. A primitive equation model is developed to test the potential significance of this tropical wave in a three dimensional atmosphere. For an idealized case ten levels in the vertical seems adequate to resolve the solution. Author

N86-11733*# National Aeronautics and Space Administration, Washington, D. C.
VARIABILITY OF SNOW COVER CHARACTERISTICS IN THE TRANSBAYKAL
R. K. Govsh Jul. 1985 12 p refs Transl. into ENGLISH from Trudy Glav. Geof. Observ., no. 130, 1962 p 78-83 Transl. by Scientific Translation Service, Inc., Santa Barbara, Calif.
(Contract NASw-4004)
(NASA-TM-77917; NAS 1.15:77917) Avail: NTIS HC A02/MF A01 CSCL 04B

The variations in snow cover characteristics in the Transbaykal were examined. Results are presented of an experimental verification of the Transbaykal theoretical developments to improve the efficiency of snow measurement photographs. E.A.K.

N86-11734*# National Aeronautics and Space Administration, Washington, D. C.
FORMATION, DISTRIBUTION AND VARIABILITY IN SNOW COVER ON THE ASIAN TERRITORY OF THE USSR
V. N. Pupkov Jul. 1985 14 p Transl. into ENGLISH from Meteorol. i Gidrolog., no. 8, 1964 p 34-40 Transl. by Scientific Translation Service, Inc., Santa Barbara, Calif.
(Contract NASw-4004)
(NASA-TM-77913; NAS 1.15:77913) Avail: NTIS HC A02/MF A01 CSCL 04B

A description is given of maps compiled for annual and average multiple-year water reserves. The annual and average multiple-year maximum snow cover height for winter, extreme values of maximum snow reserves, and the average height and snow reserves at the end of each decade are shown. These maps were made for the entire Asian territory of the USSR, excluding Central Asia, Kamchatka Peninsula, and the Sakhalin Islands. Author

N86-11735*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
METEOROLOGICAL AND ENVIRONMENTAL INPUTS TO AVIATION SYSTEMS
Dennis W. Camp, ed. and Walter Frost, ed. (Tennessee Univ. Space Inst.) Sep. 1985 144 p refs Workshop held in Tullahoma, Tenn., 26-28 Oct. 1983; sponsored by NASA, NOAA, FAA, DOD, and Office of the Federal Coordinator for Meteorology
(Contract NAS8-36177)
(NASA-CP-2388; NAS 1.55:2388) Avail: NTIS HC A07/MF A01 CSCL 04B

An overview of meteorological parameters effecting aircraft flight is presented. For individual titles, see N86-11736 through N86-11748.

N86-11736*# Federal Aviation Administration, Washington, D.C. Weather Coordination Program.
OVERVIEW OF METEOROLOGICAL INPUTS TO NASP
James C. Dziuk *In* NASA. Marshall Space Flight Center Meteorol. and Environ. Inputs to Aviation Systems Sep. 1985 p 17-21 (For primary document see N86-11735 02-47)
Avail: NTIS HC A07/MF A01 CSCL 04B

An overview of meteorological systems for forecasting flight conditions is presented. The types of equipment used to gather the information used to prepare pilot briefings and in flight advisories is described. Possible improvements to the systems are classified as short term or long term. G.L.C.

N86-11737*# Delta Air Lines, Inc., Atlanta, Ga.
AIRLINE METEOROLOGICAL REQUIREMENTS
C. L. Chandler and John Pappas (Western Airlines, Los Angeles, Calif.) *In* NASA. Marshall Space Flight Center Meteorol. and Environ. Inputs to Aviation Systems Sep. 1985 p 21-23 (For primary document see N86-11735 02-47)
Avail: NTIS HC A07/MF A01 CSCL 04B

A brief review of airline meteorological/flight planning is presented. The effects of variations in meteorological parameters upon flight and operational costs are reviewed. Flight path planning through the use of meteorological information is briefly discussed. G.L.C.

N86-11738*# Newton (Dennis W.), Reno, Nev.
GENERAL AVIATION'S METEOROLOGICAL REQUIREMENTS
Dennis Newton *In* NASA. Marshall Space Flight Center Meteorol. and Environ. Inputs to Aviation Systems Sep. 1985 p 23-26 (For primary document see N86-11735 02-47)
Avail: NTIS HC A07/MF A01 CSCL 04B

Communication of weather theory and information about weather service products to pilots in an accurate and comprehensible manner is essential to flying safety in general. Probably no one needs weather knowledge more than the people who fly through it. The specific subject of this overview is General Aviation's Meteorological Requirements. G.L.C.

N86-11739*# Business and Commercial Aviation, White Plains, N.Y.
CORPORATE/COMMUTER AIRLINES METEOROLOGICAL REQUIREMENTS
John W. Olcott *In* NASA. Marshall Space Flight Center Meteorol. and Environ. Inputs to Aviation Systems Sep. 1985 p 27-29 (For primary document see N86-11735 02-47)
Avail: NTIS HC A07/MF A01 CSCL 04B

The meteorological information requirements of corporate and commuter airlines are reviewed. The skill level and needs of this class of aviator were assessed. An overview of the methodology by which meteorological data is communicated to these users is presented. G.L.C.

N86-11740*# Federal Aviation Administration, Atlantic City, N.J.
OVERVIEW OF FAA'S AIRCRAFT ICING PROGRAM
Loni Czekalski *In* NASA. Marshall Space Flight Center Meteorol. and Environ. Inputs to Aviation Systems Sep. 1985 p 30-34 (For primary document see N86-11735 02-47)
Avail: NTIS HC A07/MF A01 CSCL 04B

An overview of the FAA's icing program is presented. The program involves certification of various types of aircraft for flight in known icing conditions, the study of icing conditions, and the preparation of certification standards. Test and technology transfer programs are also included. G.L.C.

N86-11741*# National Aeronautics and Space Administration, Washington, D. C.
OVERVIEW OF NASA'S PROGRAMS
A. Richard Tobiason *In* NASA. Marshall Space Flight Center Meteorol. and Environ. Inputs to Aviation Systems Sep. 1985 p 34-39 (For primary document see N86-11735 02-47)
Avail: NTIS HC A07/MF A01 CSCL 04B

An overview of some of NASA's aviation related programs is presented. The areas discussed include: (1) severe storms; (2) clear air turbulence; (3) icing; (4) fog; and (5) landing systems. G.L.C.

N86-11742*# Coast Guard, Elizabeth City, N.C.
ADVERSE WEATHER IMPACT ON AVIATION SAFETY, INVESTIGATION AND OVERSIGHT
Mont J. Smith *In* NASA. Marshall Space Flight Center Meteorol. and Environ. Inputs to Aviation Systems Sep. 1985 p 43-48 (For primary document see N86-11735 02-47)
Avail: NTIS HC A07/MF A01 CSCL 04B

A brief review of the weather factors that effect aviation safety with respect to U.S. Coast Guard operations is presented. Precise meteorological information is an absolute necessity to the Coast Guard which must conduct life saving and rescue operations under the worst of weather conditions. Many times the weather conditions in which they operate are the cause of or a contributing factor to the predicament from which they must execute a rescue operation. G.L.C.

N86-11743*# Naval Research Lab., Washington, D. C. Experimental Cloud Physics Section.
A NEW CHARACTERIZATION OF THE ICING ENVIRONMENT BELOW 10,000 FEET AGL FROM 7,000 MILES OF MEASUREMENTS IN SUPERCOOLED CLOUDS
Richard K. Jeck *In* NASA. Marshall Space Flight Center Meteorol. and Environ. Inputs to Aviation Systems Sep. 1985 p 51-55 refs (For primary document see N86-11735 02-47)
Avail: NTIS HC A07/MF A01 CSCL 04B

A growing requirement over the past decade for a new assessment of aircraft icing conditions in wintertime clouds at altitudes up to about 10,000 feet is discussed. The requirement was documented in past workshops and comes primarily from the helicopter community which wants ice-protected rotorcraft to meet increasing demands for all-weather operations. Currently, only a few of the larger helicopters are equipped with certification of ice-protection devices. This is because the current FAA criteria for design and certification of ice-protection equipment results in power and payload penalties that smaller rotorcraft cannot tolerate. The FAA criteria were actually designed for large, transport-category aircraft capable of flying to 20,000 feet or more. For this reason, there have been concerns that the current criteria may be too severe for low-performance aircraft, such as helicopters, which generally operate at altitudes below 10,000 feet. G.L.C.

N86-11744*# Federal Aviation Administration, Atlantic City, N.J.
A NEW CHARACTERIZATION OF SUPERCOOLED CLOUDS BELOW 10,000 FEET AGL
Charles O. Masters *In* NASA. Marshall Space Flight Center Meteorol. and Environ. Inputs to Aviation Systems Sep. 1985 p 56-59 refs (For primary document see N86-11735 02-47)
Avail: NTIS HC A07/MF A01 CSCL 04B

Icing caused by supercooled clouds below 10,000 feet were characterized with a view toward a change in FAA standards for civil aircraft ice protection standards. Current techniques in cloud physics were employed. G.L.C.

N86-11745*# Spectron Development Labs., Inc., Costa Mesa, Calif.
ADVANCE PARTICLE AND DOPPLER MEASUREMENT METHODS
Chris Busch *In* NASA. Marshall Space Flight Center Meteorol. and Environ. Inputs to Aviation Systems Sep. 1985 p 61-62 (For primary document see N86-11735 02-47)
Avail: NTIS HC A07/MF A01 CSCL 04B

Particle environments, i.e., rain, ice, and snow particles are discussed. Two types of particles addressed are: (1) the natural environment in which airplanes fly and conduct test flights; and (2) simulation environments that are encountered in ground-test facilities such as wind tunnels, ranges, etc. There are characteristics of the natural environment that one wishes to measure. The liquid water content (LWC) is the one that seems to be of most importance; size distribution may be of importance in some applications. Like snow, the shape of the particle may be an important parameter to measure. As one goes on to environment in simulated tests, additional parameters may be required such as velocity distribution, the velocity lag of the particle relative to the aerodynamic flow, and the trajectory of the particle as it goes through the aerodynamic flow and impacts on the test object. G.L.C.

N86-11746*# Flying Tigers-Retired, San Pedro, Calif.
DEVELOPMENT OF A WIND SHEAR PERFORMANCE ENVELOPE
John H. Bliss *In* NASA. Marshall Space Flight Center Meteorol. and Environ. Inputs to Aviation Systems Sep. 1985 p 62-65 (For primary document see N86-11735 02-47)
Avail: NTIS HC A07/MF A01 CSCL 04B

It is quite important that the airplane performance during a continuing headwind loss be understood. Lack of consideration of this characteristic can result in assuming almost twice the performance than that which the airplane actually has during severe wind shear at high descent rates. The example data relates to the Boeing 727-200, but the characteristics are applicable to any airplane. G.L.C.

N86-11747*# Tennessee Univ. Space Inst., Tullahoma. Atmospheric Sciences Div.
LABORATORY MODEL OF FLIGHT THROUGH WIND SHEAR
Walter Frost *In* NASA. Marshall Space Flight Center Meteorol. and Environ. Inputs to Aviation Systems Sep. 1985 p 65-67 (For primary document see N86-11735 02-47)
Avail: NTIS HC A07/MF A01 CSCL 04B

The simulation of an aircraft flying through a downdraft or microburst is presented. The simulation was performed under the conditions of constant takeoff thrust. The resulting wind shear conditions were filmed and examined for possible pilot corrective action in the future. G.L.C.

N86-11748*# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
A MODEL OF A DOWNBURST, A WIND TUNNEL PROGRAM ON PLANETARY BOUNDARY LAYER, AND AIRSHIP IN TURBULENCE
Bernard Etkin *In* NASA. Marshall Space Flight Center Meteorol. and Environ. Inputs to Aviation Systems Sep. 1985 p 68-73 (For primary document see N86-11735 02-47)
Avail: NTIS HC A07/MF A01 CSCL 04B

An engineering model of microbursts was developed as an aid to possible future flight simulation in wind shear. Planetary

boundary layer and high altitude turbulence were also modeled.
G.L.C.

N86-11749*# Pennsylvania State Univ., University Park. Dept. of Meteorology.
THE UTILIZATION OF SATELLITE DATA AND DYNAMICS IN UNDERSTANDING AND PREDICTING GLOBAL WEATHER PHENOMENA Final Report, 15 Aug. 1980 - 31 Mar. 1985
Hamilton N. Shirer, ed. and John A. Dutton, ed. May 1985 390 p refs
(Contract NAS8-33794)
(NASA-CR-171577; NAS 1.26:171577) Avail: NTIS HC A17/MF A01 CSCL 04B

A two layer spectral quasi-geostrophic model is used to simulate the effects of topography on the equilibria, the stability, and the long term evaluation of incipient unstable waves. The flow is forced by latitudinally dependent radiational heating. The nature of the form drag instability of high index equilibria is investigated. The proximity of the equilibrium shear to a resonant value is essential for the instability, provided the equilibrium occurs at a slightly stronger shear than resonance. The properties of the steady Hadley and Rossby required for a thermally forced rotating fluid on a sphere are further explained. An objective parameterization technique is developed for general nonlinear hydrodynamical systems. The typical structure is one in which the rates of change of the dependent variables depend on homogeneous quadratic and linear forms, as well as on inhomogeneous forcing terms. Also documented is a steady, axisymmetric model of the general circulation developed as a basis for climate stability studies. The model includes the effects of heating, rotation, and internal friction, but neglects topography. Included is further research on cloud street phenomena. Orientation angles and horizontal wavelengths of boundary layer rolls and cloud streets are determined from an analysis of a truncated spectral model of three dimensional shallow moist Boussinesq convection in a shearing environment is further explained. Relatively broadly spaced roll clouds have orientations for which the Fourier component of the roll perpendicular shear is nearly zero, but the second corresponds to narrowly spaced rolls having orientations for which the Fourier coefficients of both the perpendicular and the parallel components of the shear are nearly equal. For individual titles, see N86-11750 through N86-11756.

N86-11750*# Pennsylvania State Univ., University Park.
THE EFFECT OF TOPOGRAPHY ON THE EVOLUTION OF UNSTABLE DISTURBANCES IN A BAROCLINIC ATMOSPHERE Final Report
John H. E. Clark *In its* The Util. of Satellite Data and Dyn. in Understanding and Predicting Global Weather Phenomena May 1985 p 19-68 refs (For primary document see N86-11749 02-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

A two layer spectral quasi-geostrophic model is used to simulate the effects of topography on the equilibria, their stability, and the long term evolution of incipient unstable waves. The flow is forced by latitudinally dependent radiative heating. Dissipation is in the form of Rayleigh friction. An analytical solution is found for the propagating finite amplitude waves which result from baroclinic instability of the zonal winds when topography is absent. The appearance of this solution for wavelengths just longer than the Rossby radius of deformation and disappearance of ultra-long wavelengths is interpreted in terms of the Hopf bifurcation theory. Simple dynamic and thermodynamic criteria for the existence of periodic Rossby solutions are presented. A Floquet stability analysis shows that the waves are neutral. The nature of the form drag instability of high index equilibria is investigated. The proximity of the equilibrium shear to a resonant value is essential for the instability, provided the equilibrium occurs at a slightly stronger shear than resonance. F.M.R.

N86-11751*# Pennsylvania State Univ., University Park. Dept. of Meteorology.
THE HADLEY AND ROSSBY REGIMES IN A SPHERICAL ATMOSPHERE Final Report
Steven B. Feldstein and John H. E. Clark *In its* The Util. of Satellite Data and Dyn. in Understanding and Predicting Global Weather Phenomena May 1985 p 69-108 refs (For primary document see N86-11749 02-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

The properties of the steady Hadley and Rossby regimes for a thermally forced rotating fluid on a sphere are studied. The two layer modified geostrophic model is employed which allows for thermal advection by the divergent wind and time dependent static stability. Heating processes are parameterized using the Newtonian approximation and Rayleigh friction is accounted for. The equations are transformed to spectral form using spherical harmonics and then truncated retaining a simple axisymmetric state and initial, one wave. A time independent Hadley circulation is obtained which is neutral to axisymmetric disturbances but unstable to wave like perturbations for intermediate values of the meridional temperature gradient, indicating the existence of both an upper and lower symmetric Hadley regime. An analytical solution for the steady Rossby circulation is determined for values of the meridional temperature gradient where the Hadley regime is unstable. Linear perturbation theory is used to show that within the steady Rossby regime two or more waves cannot exist simultaneously. F.M.R.

N86-11752*# Pennsylvania State Univ., University Park. Dept. of Meteorology.
A PARAMETERIZATION TECHNIQUE FOR NONLINEAR SPECTRAL MODELS Final Report
Ronald Gelaro and Hampton N. Shirer *In its* The Util. of Satellite Data and Dyn. in Understanding and Predicting Global Weather Phenomena May 1985 p 109-165 refs (For primary document see N86-11749 02-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

An objective parameterization technique is developed for general nonlinear hydrodynamical systems. The typical structure of hydrodynamical systems, regardless of their complexity, is one in which the rates of change of the dependent variables depend on homogeneous quadratic and linear forms, as well as on inhomogeneous forcing terms. As a prototype of the generic problem containing this typical structure, the parameterization technique is applied to various three component subsets of a five component nonlinear spectral model of forced, dissipative quasi-geostrophic flow in a channel. The results obtained lead to specification of the necessary data coverage requirements for applying the technique in general. Author

N86-11753*# Pennsylvania State Univ., University Park. Dept. of Meteorology.
A NUMERICAL STUDY OF GLOBAL AXISYMMETRIC STATES AND THEIR STABILITY TO QUASI-GEOSTROPHIC DISTURBANCES Final Report
Harry W. Henderson and John A. Dutton *In its* The Util. of Satellite Data and Dyn. in Understanding and Predicting Global Weather Phenomena May 1985 p 167-222 refs (For primary document see N86-11749 02-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

A steady, axisymmetric model of the general circulation is developed as a basis for climate stability studies. The model includes the effects of heating, rotation, and internal friction, but neglects topography. It is assumed that the axisymmetric flow may be modeled by making the Boussinesq and deep convection approximations. The hydrostatic assumption is not made, thus permitting the advective terms to be included in the vertical equation of motion. The initial set of five primitive equations is reduced to three equations in terms of the zonal velocity, meridional streamfunction, and the potential temperature perturbation. The application of the Boussinesq, deep convection, and quasi-geostrophic assumptions limits the ranges of the heating and rotation rates. For values not too far from typical atmospheric values, the model produces a stability boundary separating Hadley from Rossby flow. The boundary is characterized by a particular value of vertical wind shear, which suggests that baroclinic instability is the primary mechanism for the loss of stability. The initial growth rates are largest for longitudinal waves 4-7, also in agreement with studies of baroclinic instability. F.M.R.

N86-11754*# Pennsylvania State Univ., University Park. Dept. of Meteorology.
ON CLOUD STREET DEVELOPMENT IN THREE DIMENSIONAL PARALLEL AND RAYLEIGH INSTABILITIES Final Report
Hampton N. Shirer *In its* The Util. of Satellite Data and Dyn. in Understanding and Predicting Global Weather Phenomena May 1985 p 223-290 refs (For primary document see N86-11749 02-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

Expected orientation angles and horizontal wavelengths of boundary layer rolls or cloud streets are determined from an analysis of a truncated spectral model of three dimensional shallow moist Boussinesq convection in a shearing environment. The nonlinear secondary circulations are organized into two dimensional forms by the height dependent wind field, and these rolls may develop from the combined effects of thermal stratification and mean wind shear. The associated thermal and parallel instability mechanisms are shown to be special cases of a single one. Only one mode is found when the stratification is unstable or neutral, but a second one is possible when the stratification is weakly stable. The first corresponds to relatively broadly spaced rolls having orientations for which the Fourier component of the roll perpendicular shear is nearly zero, but the second corresponds to relatively narrowly spaced rolls having orientations for which the Fourier coefficients of both the perpendicular and the parallel components of the shear are nearly equal. Author

N86-11755*# Pennsylvania State Univ., University Park. Dept. of Meteorology.
CLOUD STREETS DURING KONTUR: A COMPARISON OF PARALLEL/THERMAL INSTABILITY MODES WITH OBSERVATIONS Final Report
Hampton N. Shirer, Burghard Bruemmer (Max-Planck Inst. fuer Meteorologie), and Alan Grant (British Meteorological Office) *In its* The Util. of Satellite Data and Dyn. in Understanding and Predicting Global Weather Phenomena May 1985 p 291-318 refs (For primary document see N86-11749 02-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

Estimates of cloud street geometry produced by a model of the parallel/thermal instability modes of shallow convection are compared with observations obtained during the 1981 KonTur experiment. Good agreement between the modeled and observed orientation angles, wavelengths and Reynolds numbers are found when the streets are assumed to derive their energy from the average shear and the lowest order sine terms of a Fourier expansion of the mean wind profile (or equivalently from the lowest order cosine terms of the mean shear profile). The modes associated with the cosine terms of the wind profile (or the sine terms of the wind shear profile) do not agree well with the observations. These results suggest that the boundary layer rolls observed during KonTur might have developed owing to a combined parallel/thermal instability originating primarily from the cosine terms of the ambient roll parallel wind shear. Author

N86-11756*# Pennsylvania State Univ., University Park. Dept. of Meteorology.
ON THE NONLINEAR CHARACTERISTICS OF THE AXISYMMETRIC FLOW REGIME: CYLINDRICAL AND SPHERICAL SYSTEMS
R. Wayne Higgins, John A. Dutton, and Hampton N. Shire *In its* The Util. of Satellite Data and Dyn. in Understanding and Predicting Global Weather Phenomena May 1985 p 319-389 refs (For primary document see N86-11749 02-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

The physical relationship between steady axisymmetric flows that might be observed in the atmosphere and in laboratory vessels is investigated theoretically. This is accomplished by comparing both the nonlinear structure and the thermal forcing mechanisms in two truncated spectral models of flow in the atmosphere and the rotating laboratory cylinder, respectively. Under statically stable conditions, the response of the internally forced spherical model (which is developed here from a set of new orthonormal basis functions) exhibits steady behavior different from that in the externally forced cylindrical model. Two regions of multiple steady solutions occur in the cylindrical model, under stable conditions, that are not found in the spherical one. The possible physical relevance of these multiple solutions is investigated by determining their location in parameter space with respect to the classical Hadley-Rossby transition curve. The results suggest that the wave flow regime, in an annulus, might develop catastrophically when an upper symmetric flow ceases to exist. Author

N86-11757# Systems and Applied Sciences Corp., Vienna, Va.
SUB-CLOUD LAYER MOTIONS FROM RADAR DATA USING CORRELATION TECHNIQUES
G. R. Smythe and F. I. Harris 15 Oct. 1984 25 p
(Contract F19628-82-C-0023)
(AD-A156477; AFGL-TR-84-0272; SR-5) Avail: NTIS HC A02/MF A01 CSCL 04/2

Acquisition of a new system of Doppler weather radars (NEXRAD, Next Generation Weather Radar) will necessitate availability of appropriate automated weather analysis algorithms. In this report one such algorithm for obtaining small-scale motions from radar data by pattern recognition is evaluated. Two variations that correlate reflectivity data from scan to scan, one of which utilizes Doppler velocities, are applied to data of to intense thunderstorms. From these analyses it is found that resolution typical of most weather radars is too coarse to allow consistently reliable reconstruction of motions with temporal lags short enough to preclude discernible effects of propagation. Author (GRA)

N86-11758# Air Command and Staff Coll., Maxwell AFB, Ala.
RECOGNITION AND CONTROL OF LOW LEVEL WIND SHEAR
W. G. Rogers Apr. 1985 108 p
(AD-A156500; ACSC-85-2215) Avail: NTIS HC A06/MF A01 CSCL 04/2

This is a two hour lesson plan/handbook and slide presentation on low level wind shear. The project was developed for the SAC Instrument Flight Center to be used in their curriculum. The lesson plan is designed to enable SAC instructors to effectively teach other pilots how to understand, recognize, and cope with low level wind shear hazards. The lesson plan addresses the effects, causes, detection, and control of low level wind shear. Author (GRA)

N86-11759# Naval Postgraduate School, Monterey, Calif.
POSSIBLE CROSS EQUATORIAL INFLUENCE OF THE NORTHEAST MONSOON ON THE EQUATORIAL WESTERLIES OVER INDONESIA M.S. Thesis
K. A. Shield Mar. 1985 74 p
(AD-A156907) Avail: NTIS HC A04/MF A01 CSCL 04/2

Objectively analyzed surface, 700 and 200 mb winds of nine winters are used to study the possible cross equatorial influence of the northern winter monsoon on the zonal wind along 10 deg S in the Indonesia-Arafura Sea region and to prepare a nine-year monthly mean climatology. Key circulation features are represented by area averaged and time composited parameters in an attempt to infer correlations between their perturbation. Specifically, the acceleration of the zonal wind along 10 deg S in the Indonesia-Arafura Sea region is used to define the onset of the southern summer monsoon and illustrate the timing between circulation features of interest in both hemispheres. While no conclusive results were achieved, some basic observations can be made. Midseason active phases in the southern monsoon appear to be influenced by surges in the northeast monsoon in the Northern Hemisphere while late season events appear to be primarily a result of Southern Hemispheric, mid-latitude, baroclinic effects. In both cases, the meridional extent of the southern summer monsoon is limited. Even in the mid-season event, variability in area-averaged cross equatorial flow may not be indicative of the nature of forcing of the Northern Hemisphere's monsoonal winds on the southern summer monsoonal winds along 10 deg S. GRA

N86-11760# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
APPLICATION OF AN OBJECTIVE ANALYSIS SCHEME TO MESOSCALE OBSERVATIONAL NETWORK DESIGN

M.S. Thesis
D. E. Harms 1985 101 p
(AD-A156911; AFIT/CI/NR-85-43T) Avail: NTIS HC A06/MF A01 CSCL 12/1

Objective analysis is a programmable method for estimating grid point values by transforming (interpolating) data from observations at irregularly spaced points into data at the points of a regular grid mesh. The gridded information can be used for diagnostic studies or in numerical weather production models. The objective of this thesis was to estimate the probable effectiveness of the proposed surface observational network (PAM (Portable Automated Mesonet) II) which will be deployed as part of the winter 1986 GALE field project. This network is to contribute to the study of mesoscale features within developing east coast cyclones and the coastal front. The process of spatial weighted-averaging interpolation of surface data was investigated by using the Barnes objective analysis scheme. Tests were conducted to determine the limitations of the Barnes analysis method and evaluate how well this technique reconstructs meteorological fields. A method was developed which enables an optimum weight parameter to be determined for a given data distribution. Barnes objective analyses were generally more accurate than kinematic fields based on detailed hand analyses. The objective analysis scheme effectively filtered random errors typical on instrumental and exposure effects from the analysis. However, interpolation near the edge of a data domain and extrapolation into data void regions led to erroneous results. GRA

N86-11761# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METEOROLOGY OF THE PERSIAN GULF AND OF SEVERAL AIRPORTS ON THE ARABIAN COAST
G. Marcal 12 Jun. 1985 115 p Transl. into ENGLISH from Air France (France), Apr. 1980 p 1-84
(AD-A157441; FTD-ID(RS)T-0113-85) Avail: NTIS HC A06/MF A01 CSCL 04/2

Topographic location; general meteorological conditions; chief meteorological phenomena; prevailing regional winds in the gulf; Arabian Coast airports; monthly climatological statistics; hourly averages of monthly temperatures for the Persian Gulf and airports on the Arabian Coast are given. GRA

N86-11762# National Oceanic and Atmospheric Administration, Washington, D. C.
MONTHLY AND SEASONAL WEATHER OUTLOOK FOR JUNE 1985, VOLUME 39, NUMBER 11, 30 MAY 1985
Jun. 1985 10 p refs
(PB85-209526) Avail: NTIS HC A02/MF A01 CSCL 04B

Maps which give observed and probability estimates of temperature and precipitation for October and November 1984 in the United States and Canada are presented. GRA

N86-11763# National Oceanic and Atmospheric Administration, Rockville, Md.
PROCEEDINGS OF THE 9TH ANNUAL CLIMATE DIAGNOSTICS WORKSHOP
Mar. 1985 447 p refs Workshop held in Corvallis, Oreg., 22-26 Oct. 1984; sponsored by Oregon State Univ.
(PB85-183911) Avail: NTIS HC A19/MF A01 CSCL 04B

The Proceedings of the Ninth Annual Climate Diagnostic Workshop took place at Oregon State University in Corvallis, Oregon, October 22 to 26, 1984 under the auspices of the National Oceanic and Atmospheric Administration (NOAA). The session opened with a review of the world's climate fluctuations for the period September 1983 to August 1984, followed by seminars on climate diagnostics, ENSO, intraseasonal oscillations, climate variability of the west coast of the Americas, modeling, and monsoons and rainfall, prediction and specification, and special topics. For individual titles, see N86-11764 through N86-11818.

N86-11764# East Anglia Univ., Norwich (England). Climatic Research Unit.
GLOBAL SURFACE AIR TEMPERATURE VARIATIONS: 1983-1984
P. D. Jones, P. M. Kelly, and B. Santer *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 1-10 (For primary document see N86-11763 02-47)
(Contracts DE-AC02-79EV-10098; DE-AC02-81EV-10739)
Avail: NTIS HC A19/MF A01 CSCL 04B

Global surface air temperature anomaly data are discussed for the period September 1983 to August 1984 and placed in their long-term context. The values are drawn from a gridded data set updated globally using data from stations reporting on the CLIMAT network. The information is largely for the landmasses of the Northern Hemisphere and of the Southern Hemisphere north of 45 S. Data are also presented for Antarctica. Annual data for the Northern Hemisphere, the Arctic (65-85 N) and the Antarctic (65-90 S) for the period 1881 to 1983 are presented. The data are expressed as departures from the reference period 1961 to 1975. Over the Northern Hemisphere, 1983 was the fourth warmest year during the 103-year record. 1981 was the warmest year (the second and third warmest were 1938 and 1953, respectively) and 1980 to 1984 promised to be the warmest 5-year period in the record. Recent warming is close to rivalling that of the 1920s and 1930s, but is different in character. It is most noticeable in middle latitudes, whereas the earlier warming was more pronounced at high latitudes. The Antarctic warmth of the 1970s has continued into the 1980s. Author

N86-11765# National Meteorological Center, Washington, D.C. Climate Analysis Center.
MONITORING CLIMATE IN REAL TIME: AN APPLICATION OF THE CLIMATE ANOMALY MONITORING SYSTEM (CAMS)
C. F. Ropelewski *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 11-20 refs (For primary document see N86-11763 02-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

The data synthesis and analysis outlined is an attempt to realistically characterize monthly and seasonal climate anomalies in real time. The system has several potential sources of uncertainty. The reliance on unvalidated data transmitted over the GTS will undoubtedly introduce some errors. The computation of the standard deviations for temperature and parameters of the Gamma distribution or precipitation based on only 30 years of data also introduces uncertainties. Finally the isopleth analyses, a modified Cressman scheme, may give rise to errors where the data density is low and or sharp gradients exist. While these limitations must be kept in mind there is little doubt that CAMS has the capacity of providing a first look at surface climate anomalies on monthly to seasonal temporal scales and quantifying these anomalies in terms of their statistical significance. Author

N86-11766# National Meteorological Center, Washington, D.C. Climate Analysis Center.
REVIEW OF THE CLIMATE OF FALL 1983 AND WINTER 1983-84
K. Bergman and R. S. Quiroz *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 21-31 refs (For primary document see N86-11763 02-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

This review covers the major climatic events of the period September 1983 thru February 1984. Further details are given for September through November, 1983, and for December 1983 through February 1984. The first part of this summary covers tropical circulation and climatic statistics, with the main emphasis on the tropical Pacific area. Noted especially is the aftermath of the record El Nino event of 1982 to 1983. In the second part, the Northern Hemisphere circulation and its climatic effects are discussed and in the last part the focus is on conditions in the U.S., where the winter season is characterized by severe cold and wide swings in temperature. Author

N86-11767# Scripps Institution of Oceanography, La Jolla, Calif.
SOME EMPIRICAL EVIDENCE FOR THE INFLUENCE OF SNOW COVER ON TEMPERATURE AND PRECIPITATION
Jerome Namias *In* NOAA Proc. of the 9th Ann. Climate Diagnostics

Workshop Mar. 1985 p 32-43 (For primary document see N86-11763 02-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

The thermodynamic effects of variable snow cover during a given winter can alter temperature anomalies and precipitation patterns over the contiguous United States. This background acts to modulate conditions imposed by the concomitant general circulation which deploys different air masses with variable static stability. The lower tropospheric stability is responsive to the presence or absence of snow which effects the albedo and sensible heat exchange. In turn, stability alterations affect the ease with which clouds and precipitation are formed, again feeding back to alter back radiation. The winter months of 1983 to 1984 offer some remarkable illustrations of these effects because December and January were characterized by persistent and recurrent snows over much of the eastern half of the country, while an abrupt change from a low to a high index regime at the end of January led to dramatic snow melt over this area. Author

N86-11768# National Meteorological Center, Washington, D.C. Climate Analysis Center.
BLOCKING AS AN EXPLANATION OF THE SEVERE COLD OF WINTER 1983-84
R. S. Quiroz *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 44-49 (For primary document see N86-11763 02-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

The forecasting of seasonal and monthly mean temperature is often made difficult by cold-to-warm or warm-to-cold transitions within the season or month. A case in point is the winter of 1983 to 1984, which over the greater part of North America was severely cold in December (coldest December over the U.S. in at least 5 decades), very cold in January, and abnormally warm in February. The weekly resolution for surface temperature departure from normal (TDN) is given averaged over 3 U.S. latitudes, along with blocking information to be described below. The exceptional cold centered on the second half of December and middle half of January, followed by February warmth. Using flow-oriented criteria for defining blocking, a nearly four-fold increase in the number of blocking days over the east Pacific and Western North America from winter 1982 to 1983 to winter 1983 to 1984 is shown. Major winter blocking episodes (6 days or more with index of strength of associated meridional flow, N, greater than 20) were on December 15 to 30 centered near 155 deg W, January 8 to 21, nar 146 deg W; and in the Atlantic-European area on February 4 to 26, near 6 deg E. Author

N86-11769# National Meteorological Center, Washington, D.C. Climate Analysis Center.
CIRCULATION AND WEATHER FOR MAM AND JJA 1984
A. James Wagner and Chester F. Ropelewski *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 50-59 (For primary document see N86-11763 02-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

Most of the equatorial Pacific indices reveal that the atmosphere was in the cool/positive phase of the El Nino Southern Oscillation (ENSO) phenomenon. The Pacific tradewind indices are all strongly positive, with magnitudes of over 2 sigma in the area west of the dateline from March through June. There is a tendency for the area of maximum anomaly to move eastward and weaken with time. The 200 mb zonal wind index east of the dateline is near or above normal, with a tendency to increase with time. The outgoing long wave radiation (OLR) index near the dateline declines slowly from strongly to moderately positive values, indicating a general supression of convective activity in that area. The Indian summer monsoon is characterized by an excess of rainfall in the northern provinces and a tendency for a deficiency in some parts of southern India. Values of the SOI itself and the sea surface temperature anomalies (SSTA) in key areas of the eastern Pacific oscillate around zero with no discernible trends. Author

N86-11770# Scripps Institution of Oceanography, La Jolla, Calif.
ON THE RELATIONSHIP BETWEEN NORTH ATLANTIC SEASONAL SST ANOMALIES WITH UNITED STATES SURFACE TEMPERATURE ANOMALIES
Daniel R. Cayan *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 60-69 (For primary document see N86-11763 02-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

A North Atlantic sea surface temperature (SST) data set is used to form regional average anomalies from area exhibition relatively strong temporal persistence. The two SST areas considered are both located in the western North Atlantic Region 1 offshore of the northeastern United States, and Region 2 in the subtropic area of the Caribbean and to its east. These regions are defined in the four month lag autocorrelation field over the North Atlantic; for comparison the four month lag autocorrelation for the North Pacific is shown. (Note that in the North Pacific the amplitude and spatial extent of the maximum autocorrelation coefficients are similar to those in the North Atlantic, but clustered in around the eastern boundary rather than the weatern.) Time series of the SST in the two regions are graphed; the variance of Region 1, reflecting its midlatitude, western boundary location is quite high, while the variance of Region 2 is rather small, being a subtropical area. Both regions exhibit a fairly decided low frequency character, although Region 2 appears more homogeneous throughout the 1949 to 1981 record length. Author

N86-11771# British Meteorological Office, Bracknell (England).
WORLDWIDE MARINE TEMPERATURE VARIATIONS ON THE SEASON TO CENTURY TIME SCALE
C. K. Folland, D. E. Parker, and M. Newman *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 70-85 refs (For primary document see N86-11763 02-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

Recently, an analysis of global and N. Hemisphere sea surface temperature (SST) and night marine air temperature (MATN) variations during 1856 to 1981 was published. The work is partly motivated by the desire to find out, in the context of a long-term research program on long-range forecasting for the UK, whether a deterministic explanation can be sought for any of several substantial long-lasting circulation fluctuations in the N. Atlantic region over the last century. These have sometimes led to large fluctuations in mean temperature or rainfall within the UK that have been coherent over decades. Author

N86-11772# National Climatic Center, Asheville, N. C. National Climatic Data Center.
RECENT UNUSUAL MEAN WINTER TEMPERATURE ACROSS THE CONTIGUOUS UNITED STATES
Thomas R. Karl, Robert E. Livezey (Climate Analysis Center, Camp Springs, Md.), and Edward S. Epstein (Climate Analysis Center, Camp Springs, Md.) *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 86-90 (For primary document see N86-11763 02-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

A long time series (1895 to 1984) of mean areally-averaged winter temperatures in the contiguous United States depicts an unprecedented spell of abnormal winters beginning with the winter of 1975 to 1976. The data set used to obtain areally-weighted average winter temperatures consists of monthly averages of temperature for each of 344 state climatic divisions in the contiguous United States and, prior to 1931, monthly averages of statewide average of temperature derived by a simple average of the data from stations within a state. The data set is then corrected for spatial density of stations prior to 1931, systematic time of observation bias, and urban warming. Each of these corrections is empirically derived by previously published correction factors or by comparison to a fixed network in the case of station density prior to 1931. A plot of the time series with time of observation and urban warming corrections versus the series without these corrections is depicted. Author

N86-11773# Maryland Univ., College Park. Dept. of Meteorology.

TOWARDS UNDERSTANDING THE GEOGRAPHICAL DISTRIBUTION AND SEASONALITY IN PERSISTANCE OF MONTHLY MEAN SURFACE AIR TEMPERATURE OVER THE U.S.A.

H. M. VandenDool and W. H. Klein *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 91-95 refs (For primary document see N86-11763 02-47)

(Grants NSF ATM-83-14431; NA-83AA-D-00048)

Avail: NTIS HC A19/MF A01 CSCL 04B

Using the traditional linear correlation (rho) between anomalies in monthly mean air temperature (MMAT) occurring in adjacent months, we will describe the distribution of rho over the U.S.A. and its variation with season. Rho(i,s,tau,n,m) is a function of the starting month (i), the station (s), the lag (tau), and the period over which calculations were performed (starting year n, ending year m). In this report tau will be 1 month exclusively. The data set used is the 80 year (1900 to 1979) record for 61 stations over the U.S.A. Author

N86-11774# Lamont-Doherty Geological Observatory, Palisades, N. Y.

TEMPERATURE AND PRECIPITATION TRENDS IN NORTH AMERICA

G. Kukla, J. Gavin, and T. R. Karl (National Climatic Center) *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 96-100 refs (For primary document see N86-11763 02-47)

(Contract DE-AC02-83ER-60162)

Avail: NTIS HC A19/MF A01 CSCL 04B

Trends in monthly mean maximum, minimum and average temperature as well as precipitation are calculated over the 1941 to 1980 interval for 122 to 130 U.S. and Canadian stations. Correlation coefficients are used to measure the association between each element and time (in 40 equal time steps) and are tested for local significance using a Monte Carlo technique. Field significance tests are then used to determine whether the percentage of stations in the network with > or = 90% local significance level is greater than expected due to chance. Stations are selected to minimize as much as possible the potential influence of urbanization. Author

N86-11775# Oregon State Univ., Corvallis. College of Oceanography.

RECENT LONG-TERM CLIMATIC CHANGE OVER THE EASTERN TROPICAL AND SUBTROPICAL PACIFIC AND ITS RAMIFICATIONS

William H. Quinn and Victor T. Neal *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 101-109 refs Supported in part by The Tinker Foundation (For primary document see N86-11763 02-47)

(Grant NSF ATM-83-06135)

Avail: NTIS HC A19/MF A01 CSCL 04B

Information concerning the climatic change that has affected much of the tropical and subtropical Pacific over recent years is discussed and illustrated with graphs. It provides an additional approach for monitoring and assessing the ENSO events, based on changes noted at sites located in the southeast trade band. It also includes a discussion of related changes noted at tropical North Pacific sites. Author

N86-11776# Washington Univ., Seattle.

GLOBAL RELATIONSHIPS WITH THE SOUTHERN OSCILLATION

P. B. Wright, T. P. Mitchell, and J. M. Wallace *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 110-113 (For primary document see N86-11763 02-47)

Avail: NTIS HC A19/MF A01 CSCL 04B

An atlas was prepared comprising maps of correlation and regression coefficients between various surface meteorological fields over the global oceans and an index of the Southern Oscillation (SO). The fields are: sea-surface temperature (SST), sea-level pressure (SLP), sea minus air temperature (S-A), cloudiness and wind components. The data are monthly anomalies in 4 deg latitude by 10 deg longitude areas for the period 1950 to 1979, generated from the COADs set. The SO index is the SLP anomaly at Darwin averaged over the twelve months beginning in April of one year and ending in March of the next; this is reversed in sign to the traditional SO index. Global maps of correlation and regression coefficients are calculated for six seasons defined relative to the twelve months of the SO index. This choice provides a description of the time evolution of seasonal anomalies relative to fluctuations of the SO. The maps reveal many interesting features, some very familiar, others less so. Sample maps for the Indian and Pacific sectors are shown. A few of the features are monitored with emphasis on the less familiar. The anomalies mentioned tend to be associated with high Darwin pressure, and anomalies of opposite sign with low Darwin pressure. Author

N86-11777# Oregon State Univ., Corvallis. Dept. of Atmospheric Sciences.

TIME SERIES MODELING OF THE SOUTHERN OSCILLATION Abstract Only

Pao-Shin Chu and Richard W. Katz (National Center for Atmospheric Research) *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 114 (For primary document see N86-11763 02-47)

Avail: NTIS HC A19/MF A01 CSCL 04B

An index consisting of the difference of normalized sea level pressure departure between Tahiti and Darwin during 1935 to 1983 is used to monitor the Southern Oscillation (SO) fluctuation. Using a time domain approach, autoregressive moving average (ARMA) processes are applied to model the Southern Oscillation Index (SOI) on a monthly and seasonal basis. An objective model selection procedure is used to help identify the appropriate time series model. It is shown that a low order ARMA process, namely ARMA(1,1), adequately fits the monthly SOI. According to this process, the SOI for the current month can be expressed as a function of the state of the previous month SOI and a current month's random error plus a previous month's error. Strong midlatitude forcing as induced by the cold surge during winter season appears to be one of many possible mechanisms which would perturb the large scale mass circulation. For the seasonal data, an AR(3) process is found to be the most adequate time series model. For this process, the current value of the SOI can be represented in terms of its immediate three post values and a noise term. Author

N86-11778# Colorado Univ., Boulder. Cooperative Inst. for Research in Environmental Science.

SATELLITE OBSERVATIONS OF A LARGE-AMPLITUDE 40-50 DAY OSCILLATION IN UPPER TROPOSPHERIC TEMPERATURE OVER THE EQUATORIAL PACIFIC OCEAN DURING THE 1982-83 ENSO EVENT

Edward I. Tollerud *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 115-118 refs (For primary document see N86-11763 02-47)

Avail: NTIS HC A19/MF A01 CSCL 04B

An oscillation is described with a period near 50 days that was observed in the atmospheric temperature fields over the equatorial Pacific Ocean in 1982 to 1983. The results show that there is an apparent relationship between the amplitude of the oscillation and the on going ENSO event. The data used are temperature retrievals from NOAA polar orbiting satellites. The basic averaging unit applied to the retrievals was 5 days in duration and 5 deg of latitude and longitude in horizontal dimension. While providing sufficient time resolution to describe oscillations of the period of interest, this choice of averaging period and area also results in an adequate sample of retrievals in each averaging area. Fields of these averages were used to construct time series and sections like those presented here. Author

N86-11779*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SUBSEASONAL AND INTERANNUAL VARIATIONS OF TROPICAL CONVECTION AND THE EL NINO/SOUTHERN OSCILLATION

K. M. Lau and P. H. Chan (Applied Research Corp., Landover, Md.) *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 119-122 (For primary document see N86-11763 02-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

It was found that during the northern winter, fluctuation in tropical convection is dominated by eastware propagating cloud clusters from the Indian Ocean. Most of these clusters reach as far as the central Pacific. Longitude time sections of outgoing longwave radiation (OLR) anomaly along the equator show that there are about 3 to 4 such episodes each winter. Also, simultaneous OLR anomalies over the equatorial central Pacific (ECP) and the maritime continent (MC) are negatively correlated and their variations are dominated by a 40 to 60 day period, suggesting the presence of a standing wave phenomenon. Such combination of propagating and standing phenomena can be captured by the extended empirical orthogonal function (EEOF) analysis. The EEOF method combines the temporal as well as the spatial correlation information to produce eigenmodes which have space time dependence. A 5 day and a 10 day lag in addition to the simultaneous spatial correlation is used. Author

N86-11780# National Center for Atmospheric Research, Boulder, Colo.
THE ANNUAL VARIATION IN THE VERTICAL STRUCTURE OF THE 40-50-DAY TROPICAL OSCILLATION
Roland A. Madden *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 123-127 (For primary document see N86-11763 02-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

Spectra based on relatively long time series (5 to 10 or more years) of station pressure and upper air data from tropical regions reveal relatively broad spectral peaks whose maxima typically fall in the 40 to 50 day period range. The lower tropospheric zonal wind is very coherent and out of phase with the upper tropospheric zonal wind. To date, these results have been based on time series which open all seasons. The aim here is to learn something of the annual variation of this vertical structure. Author

N86-11781# Wisconsin Univ., Madison. Center for Climatic Research.
LIFE CYCLE OF A 28-72 DAY ATMOSPHERIC OSCILLATION DURING NORTHERN WINTER
Klaus M. Weickmann and John E. Kutzbach *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 128-140 refs (For primary document see N86-11763 02-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

The spatial and temporal characteristics of 28 to 72 day fluctuations in NMC analyzed 250mb wind and satellite derived outgoing longwave radiation (OLR) is investigated. The ensemble averaged statistics described are calculated using 9 different (1974 to 1984) Nov. to Apr. and May to Oct. periods. This data base gives approximately 36 realizations of 28 to 72 day oscillations for each season. An overview of the seasonal differences in the spatial structure and the propagation characteristics of 28 to 72 day oscillations in 250mb wind and OLR are described first. This is followed by description of the life cycle of 28 to 72 day oscillations during northern winter; the life cycle highlights a systematic relationship between the evolution of OLR and the 250mb circulation. Author

N86-11782# Scripps Institution of Oceanography, La Jolla, Calif.
THE DISTRIBUTION OF RAINFALL ALONG THE COAST OF NORTHERN PERU DURING 1982-83
J. D. Horel and A. Cornejo-Garrido *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 141-146 (For primary document see N86-11763 02-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

Torrential rainfall and severe flooding along the normally arid coast of Northern Peru caused considerable hardship to its inhabitants. Although past episodes of intense convection were linked to the El Nino phenomenon, the mechanisms responsible for the changes in the regional atmospheric circulation have yet to be adequately explained. Rainfall and surface wind observations were obtained from a network of roughly 50 stations in northern Peru, in addition to gridded data sets available in the United States. Preliminary results are presented on the conditions along the west coast of South America during the 1982 to 1983 El Nino episode. Author

N86-11783# Oregon State Univ., Corvallis. College of Oceanography.
PERU COASTAL WINDS DURING 1982-1983
D. B. Enfield and P. A. Newberger *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 147-156 refs (For primary document see N86-11763 02-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

Synoptic data are presented on winds from seven coastal stations from northern and central Peru, from 1 January 1981 to the last quarter of 1983. To isolate synoptic and longer time scale variability from the diurnal signal, the basic data were smoothed with a low-low pass (LLP) filter having a half amplitude at 40 hours and decimated to six hourly values. A second set of time series was formed by further smoothing the LLP data with a very low pass (VLP) filter having half-amplitude at 30 days. The LLP variability is shown as vector sticks, while both the LLP and VLP time series are shown in plots of the alongshore wind component. Author

N86-11784# Clark Univ., Worcester, Mass. Geography Dept.
CLIMATIC EVENTS OF THE WEST COAST OF SOUTHERN AFRICA
Sharon Nicholson and Dara Entekhabi *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 157-165 (For primary document see N86-11763 02-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

Suggestions have been made that the warm water is here also coupled with increased coastal rainfall and possibly with the Southern Oscillation as well. That idea is tested by using time series analysis and multi-year composites to examine the relationship between rainfall, SSTs and the Southern Oscillation. The data base consists of monthly SST data for 1948 to 1972 for the Marsden squares and derived from the TDF-11 data set, monthly rainfall data for the coastal stations indicated and for 84 regions covering the entire continent. The length of the rainfall records varies considerably, but most coastal stations have data for at least the period 1948 to 1972 and the regional series generally commence around 1901 and extend to 1973. Author

N86-11785# Naval Postgraduate School, Monterey, Calif.
SEVERAL ASPECTS OF INTERANNUAL VARIABILITY IN THE CALIFORNIA CURRENT SYSTEM
C. N. K. Mooers and L. C. Breaker *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 166-172 refs (For primary document see N86-11763 02-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

Sea-surface temperature (SST) time series of daily observations acquired along the Central California coast are examined for interannual variability. A 13-year record off Pt. Sur clearly reveals three warming episodes that coincide with Equatorial ENSO events. Also a warming was observed in 1979; this episode coincides with a relatively weak ENSO event observed mainly in the Western and the Northeastern Pacific. These mid-latitude responses have been referred to as California El Ninos. Trend analysis of the Pt. Sur time series revealed a significant increase in SST over the past 13 years. Both the most recent El Nino episode and a large scale warming that started in 1976, appear to have contributed to the long term increase. Author

N86-11786# Scripps Institution of Oceanography, La Jolla, Calif. Marine Life Research Group.
WARM AND COLD EPISODES IN THE CALIFORNIA CURRENT: A CASE FOR LARGE-SCALE MID-LATITUDE ATMOSPHERIC FORCING
James J. Simpson *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 173-184 refs (For primary

document see N86-11763 02-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

This paper examines time series of oceanographic variables which indicate the occurrence of warm (EL Nino-like) and cold (anti-El Nino-like) periods in the California Current. Large-scale distributions of atmospheric data are then used to show that the most intense mid-latitude warm periods generally are contemporaneous with periods of pronounced tropical El Nino Southern Oscillation (ENSO) activity and that the most intense mid-latitude cold periods are contemporaneous with periods of pronounced tropical El Nino Southern Oscillation ENSO activity. Strong mid-latitude warm periods, however, can occur without contemporaneous tropical ENSO activity. In all cases, however, mid-latitude warm periods are associated with an expansion and intensification of the Aleutian Low, while the corresponding cold periods are associated with an expansion and intensification of the North Pacific High. Oceanographic data support the conclusion that mid-latitude warm (cold) periods in the California Current are related to observed anomalous atmospheric circulation through enhanced onshore (offshore) large-scale wind-driven oceanic transport. B.W.

N86-11787# Colorado Univ., Boulder. Cooperative Inst. for Research in Environmental Sciences.
RELATIONSHIPS BETWEEN PACIFIC NORTHWEST COAST CLIMATE AND ENSO EVENTS
Brent Yarnal *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 185-192 (For primary document see N86-11763 02-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

The extremes in climate experienced during the 1982 to 1983 El Nino Southern Oscillation (ENSO) have generated considerable interest in the effect such episodes have on regional climatic variation. Surprisingly, not much is known about the relationships between ENSO events and the climate of the Pacific Northwest. Here, associations between ENSO events and the winter climate of eight coastal climatological divisions are investigated, with special emphasis given to the Washington coast and southeastern Alaska in the later parts of the paper. B.W.

N86-11788# National Weather Service, Portland, Oreg.
EVIDENCE OF AN 18 YEAR CYCLE IN PACIFIC NORTHWEST PRECIPITATION DATA
Philip A. Peck and Vernon C. Bissell *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 193-198 (For primary document see N86-11763 02-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

This is a preliminary report on the basis of evidence that a cyclical pattern of about 19 years recurrence is seen in precipitation at selected stations in Western Oregon and Western Washington. The coincidence of these climate fluctuations with total solar eclipse events having periodicities of the same interval suggests that the causation may be lunar-gravitational. Drought cycles based on tree-ring analysis by Mitchell, Stockton and Meko were then compared with pacific Northwest precipitation changes and compared with total solar eclipse periodicities. Total solar eclipse over the Northern Hemisphere were considered to provide the best lunar-rainfall relationship. Nine stations in Western Washington and Northwest Oregon were used in this study. Four of these station's records were extended by using data from adjacent stations and normalizing the data. All stations have a marked winter rainfall climate. B.W.

N86-11789# Oregon State Univ., Corvallis. Dept. of Atmospheric Sciences.
TIME-AVERAGING THE FLUX-PROFILE RELATIONSHIP
Larry Mahrt, Claude Berthou (Centre National de Recherches Meteorologiques, Toulouse, France), Pascal Marquet, and Jean-Claude Andre *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 199-200 ref (For primary document see N86-11763 02-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

Surface fluxes are generally related to mean flow variables by use of the bulk aerodynamic relationship and associated surface exchange coefficient. However, use of long time steps, as well as implied averaging over grid volumes can greatly alter the formal relationship between the flux and the mean flow. Formulations are presented for determining the bulk aerodynamic relationship for the surface turbulent flux using time step averaging. B.W.

N86-11790# Oregon State Univ., Corvallis. Climatic Research Inst.
ATMOSPHERIC GENERAL CIRCULATION MODEL SIMULATIONS OF THE MODERN ANTARCTIC CLIMATE
Michael E. Schlesinger *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 201-210 refs (For primary document see N86-11763 02-47)
(Grant NSF ATM-82-05992)
Avail: NTIS HC A19/MF A01 CSCL 04B

In this paper the modern summer and winter climates in and around Antarctica simulated by six contemporary global atmospheric general circulation models (AGCMs) are compared with the corresponding observed climates. The models are listed along with their characteristics and simulations. The simulated and observed climates are presented in terms of their surface air temperatures, sea-level pressures, precipitation rates, and cyclogenesis and cyclone tracks. Results for selected model simulations are presented. A discussion of this intercomparison is given. B.W.

N86-11791# National Center for Atmospheric Research, Boulder, Colo.
ATMOSPHERIC RESPONSE TO AN EQUATORIAL PACIFIC SEA SURFACE TEMPERATURE ANOMALY: THE EFFECTS OF OROGRAPHY
M. L. Blackmon, G. T. Bates, and J. E. Geisler (Utah Univ., Salt Lake City) *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 211-217 (For primary document see N86-11763 02-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

General circulation model experiments, carried out using the Community Climate Model (CCM) at the National Center for Atmospheric Research (NCAR) are described. All of these experiments are perpetual January, and they start at day 200, this being the time taken to spin up the model to some natural climatic state which is taken as the initial condition in all the experiments. A typical experiment runs for 1200 days after that. This record is divided into eight 90-day segments, each separated by a 60-day segment. Eight samples of independent 90-day realizations of winter climate averaged over the 90-day span are presented. This average is known as an ensemble average. Two basic categories of such ensemble-average winter climates are presented. One is the control ensemble; the other is the anomaly ensemble, in which the Sea Surface Temperature (SST) pattern is that used for the control experiment plus some SST anomaly in the equatorial Pacific. Two features of the anomalous response are investigated: the tropical anticyclone pair and the chain of alternating highs and lows that has come to be called the PNA pattern. B.W.

N86-11792# Canadian Climate Centre, Downsview (Ontario).
HORIZONTAL FLUXES IN REAL AND MODEL ATMOSPHERES
G. J. Boer *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 218-224 refs (For primary document see N86-11763 02-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

Large-scale vertically integrated fluxes of moisture and energy, together with the associated distribution of sources and sinks, are basic climatological parameters of the atmosphere. Global distributions of these quantities have only recently become available from the PGGE 3-b data set. Quantities obtained from the FGGE 3-b data set observations are compared with those from general circulation models, such as the Canadian Climate Center GCM. B.W.

N86-11793# Royal Netherlands Meteorological Inst., De Bilt.
THE IMPACT OF HEAT SOURCES IN THE TROPICS ON THE ATMOSPHERIC CIRCULATION

R. Mureau, J. D. Opsteegh, and J. S. Winston (Maryland Univ., College Park) *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 225-230 (For primary document see N86-11763 02-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

Observational and Global Circulation Model (GCM) studies have produced evidence of the importance of heat sources in the tropics for the global atmospheric circulation. Linear steady state models have been considered a useful tool to demonstrate the process of energy propagation out of the tropics, and have in a qualitative way contributed to the understanding of GCM's and also of the real atmosphere. Little is known, however, to what extent linear models can produce quantitatively realistic circulation patterns in response to observed forcing. An attempt was made to simulate with a liner 15 layer steady state model the observed anomalies for a large number of seasons. Seasonal mean outgoing longwave radiation (OLR) anomalies in the tropics were used as a proxy for the anomalous seasonal mean diabatic heating for all seasons during the years 1974 to 1983. Other forcing terms have been ignored. Simulated anomalous streamfunctions at 300 mb and 700 bm are objectively verified, by computing pattern correlation coefficients (pcc). B.W.

N86-11794# Maryland Univ., College Park. Dept. of Meteorology.
THE EFFECT OF ANOMALOUS SNOW COVER ON THE GENERAL CIRCULATION OF THE ATMOSPHERE USING A SIMPLE CLIMATE MODEL
Alan Robock and James W. Tauss *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 231-237 refs (For primary document see N86-11763 02-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

The effect of anomalous snow cover has long been studied as having a pronounced influence on the temperature of the overlying atmosphere. However, little if any literature has described the incorporation of such a forcing into a climate model to investigate the anomalous atmospheric response. It is the purpose of this paper to study the effects of such anomalous forcings when imposed on a given basic state using a simple, linear, steady-state climate model. Some preliminary results are discussed. B.W.

N86-11795# Australian Numerical Meteorology Research Center, Melbourne.
INTERANNUAL CLIMATE VARIABILITY IN A LOW VERTICAL RESOLUTION SPECTRAL ATMOSPHERIC MODEL
Hal B. Gordon *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 238-245 (For primary document see N86-11763 02-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

A 2-level spectral atmospheric model has been integrated for a total of 10 model years. This run is now being analyzed and some preliminary results are presented here concentrating on the interannual variability (IV) generated. B.W.

N86-11796*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VARIABILITY SIMULATIONS WITH A STEADY, LINEARIZED PRIMITIVE EQUATIONS MODEL
James L. Kinter, III and Sumant Nigam (Massachusetts Inst. of Tech., Cambridge) *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 246-249 ref (For primary document see N86-11763 02-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

Solutions of the steady, primitive equations on a sphere, linearized about a zonally symmetric basic state are computed for the purpose of simulating monthly mean variability in the troposphere. The basic states are observed, winter monthly mean, zonal means of zontal and meridional velocities, temperatures and surface pressures computed from the 15 year NMC time series. A least squares fit to a series of Legendre polynomials is used to compute the basic states between 20 H and the equator, and the hemispheres are assumed symmetric. The model is spectral in the zonal direction, and centered differences are employed in the meridional and vertical directions. Since the model is steady and linear, the solution is obtained by inversion of a block, pentediagonal matrix. The model simulates the climatology of the GFDL nine level, spectral general circulation model quite closely, particularly in middle latitudes above the boundary layer. This experiment is an extension of that simulation to examine variability of the steady, linear solution. B.W.

N86-11797# California Univ., Davis. Dept. of Land, Air and Water Resources.
UNDERSTANDING EL NINO EVENTS USING A SIMPLE DYNAMICAL ATMOSPHERE MODEL
Bryan C. Weare *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 250-256 (For primary document see N86-11763 02-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

A simple model is outlined which illustrates possible feedback mechanisms linking oceanic surface conditions with tropical atmospheric heating and surface circulation. The results of the model suggest the importance of feedback mechanisms in the initiation and development of El Nino episodes. The basic model is patterned after the reduced gravity model on an equatorial Beta-plane introduced by Gill om 1980. The equations giving solutions for the perturbations of the winds pressure, vertical velocity, and potential temperature are given. Unlike most previous uses of this model, the forcing function will not be fixed but will be a function of the model circulation together with fixed oceanic conditions. R.J.F.

N86-11798# Princeton Univ., N. J. Geophysical Fluid Dynamics Lab.
ANOMALY GENERAL CIRCULATION MODELS
A. Navarra and K. Miyakoda *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 257-261 refs (For primary document see N86-11763 02-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

The construction of a baroclinic anomaly model, based on an existing general circulation model (GCM) is discussed. Both a time-dependent, non-linear version, and a steady, linear version of the anomaly model were prepared, but only the application of the steady, linear model is discussed. Since the full GCM and the anomaly GCM are closely related, the anomaly model may facilitate the investigation of dynamical characteristics of the solution of full GCM, if an appropriate set of basic state and forcing is specified. The anomaly model based on a spectral general circulation model (GCM) is formulated and applied to the simulation of a January 1983 case. The steady anomaly model is solved by a matrix method using the Krylov technique to handle large linear systems. R.J.F.

N86-11799# Hawaii Univ., Honolulu. Dept. of Meteorology.
TRANSITION FROM THE SOUTHERN TO NORTHERN HEMISPHERE SUMMER MONSOON
Takio Murakami *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 262-264 (For primary document see N86-11763 02-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

To facilitate the discussion, any meteorological variable is separated into two important components. The first component is symmetric about the equator and shows relatively small seasonality. The second component is asymmetric about the equator with convective zones showing a distinct seasonal pattern between the Southern and Northern Hemisphere summer. For example, OLR outgoing longwave radiation (OLR) can be partitioned into two components as follows: OLR(+) = 1/2(OLR sub N + OLR sub S), OLR(-) = 1/2(OLR sub N - OLR sub S), where OLF(+) and OLR(-) represents the symmetric and asymmetric components, respectively; OLR sub N (OLR sub S) denotes OLR in the Northern (Southern) Hemisphere. OLF(+) is small, irrespective of season, over equatorial Africa (20 to 40 E), the waritime countinent (100 to 160 E), and equatorial South America (110 t 70 W). These are three of the most convectively active regions near the equator.

Response to OLR(+) is generally confined to the equatorial latitudes and is often called the Walker Circulation. R.J.F.

N86-11800# National Meteorological Center, Washington, D.C. Climate Analysis Center.

LARGE-SCALE VARIABILITY IN INDIAN MONSOON RAINFALL INFERRED FROM SATELLITE DATA

Phillip A. Arkin, John E. Janowiak, and William Replane *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 265-273 (For primary document see N86-11763 02-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

The object is to investigate the practicality of diagnosing rainfall variability by means of the indices constructed from the NOAA outgoing longwear radiation (OLR) data set. The principal conclusions drawn from this study are given: (1) Indices using thresholds of 240Wm(-2) appeared to define the large-scale annual cycle in monsoon area rainfall reasonably well. It seems that an index using the mean flux would provide much of the same information; (2) Onset of the monsoon, defined as three consecutive five day periods with index values above 0.4, was observed in each area/year examined here; (3) Onset progressed from south to north in a regular fashion; (4) Onset occurred latest in the Indian and Arabian Sea index areas, with differing sequences in different years. It seems possible that onset occurs first in the Arabian Sea during years in which an onset vortex occurs; (5) Important features of the interannual variability in monsoon rainfall were seen in the time series of standardized anomalies; (6) The drought of 1979 appears to have been a feature of the Indian and Arabial Sea index areas only; (7) The monsoon season of 1976 appears to have been relatively dry over the entire region; and (8) the results here are encouraging enough to warrant an effort to produce a precipitation index. R.J.F.

N86-11801# Illinois State Water Survey, Champaign. Climate and Meteorology Section.

TROPOSPHERIC STATIC STABILITY AND CENTRAL NORTH AMERICAN RAINFALL DURING 1979

Peter J. Lamb and Randy A. Peppler *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 274-283 (For primary document see N86-11763 02-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

The occurrence, rate, and duration of precipitation in a continental region are likely to be functions of the existence and strength of several atmospheric processes and conditions over the region itself and, in particular, the degree to which they are simultaneously favorable. It is hypothesized that, in very general terms, such processes/conditions include the local presence and external supply of water vapor, and the troposphere's predisposition to providing the vertical motion necessary to produce the required condensation rates. One condition of potential importance in the latter regard is tropospheric static stability. This steady-state property indicates the likelihood of introduced vertical displacements or perturbations being thermodynamically damped, enhanced, or unchanged. The relation between tropospheric static stability and central North American summer (May-August) rainfall for 1979 is investigated. The first objective is to ascertain which of the many available methods of parameterizing static stability are most strongly related to the variation of the above rainfall. A rational basis is sought for the characterization of static stability. The second objective is to quantify the fraction of the 1979 rainfall variance that can be explained by static stability alone (i.e., by just one of the above processes/conditions). R.J.F.

N86-11802# Washington Univ., Seattle. Dept. of Atmospheric Sciences.

METEOROLOGICAL CONDITIONS DURING DROUGHT EPISODES IN THE UNITED STATES GREAT PLAINS

Fong-Chiau Chang and John M. Wallace *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 284-291 refs (For primary document see N86-11763 02-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

Historical droughts over the central United States (1889 to 1980) and their associated large-scale circulation patterns and land-surface moisture conditions are investigated, using climatological monthly mean surface data, rawinsonde data, Palmer drought severity indices, 82 years of gridded monthly mean sea-level pressure data, and 30 years of gridded 5-day mean sea-level pressure and 500 mb height data. Surface station data include monthly mean surface pressure, maximum and minimum temperatures, temperature range, monthly total precipitation, dew point and relative humidity. Anomalies in monthly mean surface air temperature at Kansas City were used as a basis for objectively ranking the 276 months in the 92 summers, 1889 to 1980. A striking feature that emerges is the concentration of drought months in the decades of the 1910's, 1930's, and 1950's. Many of the hot months enhibit negative anomalies in relative humidity, dew point, precipitation and Palmer drought severity index. The drought months during the 1930's were characterized by extreme negative relative humidity anomalies and very low Palmer drought severity indices. These results support the view that soil moisture plays an important role in droughts. R.J.F.

N86-11803# Princeton Univ., N. J. Geophysical Fluid Dynamics Lab.

MONTHLY FORECAST EXPERIMENTS WITH SEA SURFACE TEMPERATURE ANOMALY FORCINGS AND ENVELOPE MOUNTAINS: PRELIMINARY RESULTS

J. Strutis, K. Niyakoda, Y.-H. Lu, and J. Ploshay *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 292-295 (For primary document see N86-11763 02-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

A series of 30 day forecasts were made for January 1983 to assess the impact of using observed sea surface temperature and envelope mountains on medium and long range forecasting. The basic model used in these studies is the Geophysical Fluid Dynamics Laboratory global finite difference model. The model has a resolution of 1.875 deg in the north-south direction, and a variable resolution in the east-west direction, ranging from 1.875 deg in the tropics to 10 deg near the poles. The model has 9 sigma levels in the vertical. A set of four experiments has been run with this model: the control experiment using climatological sets and smooth topography; a forecast with envelope mountains which are steeper than those used in the control run; a forecast using the observed sets of January 1983; and a forecast using both observed sets and envelope mountains. Results are discussed. Author

N86-11804# Scripps Institution of Oceanography, La Jolla, Calif.

SPECTRAL STATISTICAL FORECASTS OF THE 500 MB HEIGHT FIELD

John O. Roads and Tim P. Barnett *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 296-304 (For primary document see N86-11763 02-47)
(Grants NSF ATM-82-13279; NSF ATM-82-10160; NA-81AA-D-0054)
Avail: NTIS HC A19/MF A01 CSCL 04B

A simple dynamic model used to describe global weather variations is based on damped propagating Rossby waves. For motions on the sphere, the solution is developed in terms of associated Legendre polynomials. In terms of a damped barotropic model linearized around solid body rotation for the nonzonal component, the solution can be found analytically. A data set is used consisting of twice daily spherical harmonics for the Northern Hemisphere 500 mb height field. Ten years of data are available. Coefficients for the model are determined using least squares from the first five years, which were then tested against the coefficients for the second five years. F.M.R.

N86-11805# Rutgers - The State Univ., New Brunswick, N. J. Dept. of Meteorology.

PREDICTION OF MONTHLY 700 MB HEIGHTS USING ANTECEDENT AND SIMULATED PROGNOSTIC HEIGHT PREDICTORS

Robert Harnack, Charles Kluepfel (Science Systems and Applications, Inc., Seabrook, Md.), and Robert E. Livezey (National Meteorological Center, Washington, D.C.) *In* NOAA Proc. of the

9th Ann. Climate Diagnostics Workshop Mar. 1985 p 305-316 (For primary document see N86-11763 02-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

This study has two parts. The first is the study of persistence relationships by computing pattern correlations between time-averaged Northern Hemisphere 700 mb height fields ending on the 28th of the month and monthly-averaged heights for the following month. The second portion examines hindcast skill for monthly-mean 700 mb heights using antecedent heights, simulated prognostic heights, and a combination of both. Raw data consists of daily 700 mb heights in the period 1948 to 1980 for the Northern Hemisphere from 25N to 75N. Pattern correlations are computed between height fields consisting of time-averages for the last n days of an antecedent month on the one hand and the height field of the entire following (target) month on the other. Results are presented as average pattern correlations for calendar month pairs. These show a general tendency for maximum correlations at small n in the spring, and intermediate or large n in other months especially in mid-winter and mid-summer. F.M.R.

N86-11806# Maryland Univ., College Park. Dept. of Meteorology.
SPECIFICATION OF MEAN SURFACE TEMPERATURE ANOMALIES IN EUROPE AND ASIA DURING THE FALL MONTHS
William H. Klein and Runhua Yang *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 317-325 (For primary document see N86-11763 02-47)
(Grant NA-83AA-D-00048A1)
Avail: NTIS HC A19/MF A01 CSCL 04B

This paper extends research for the United States and Canada reported previously to a network of 68 surface stations in the European sector and 47 in Asia. Monthly mean air temperature anomalies near the surface (MMATA) at 134 grid points, plus the previous month's local MMATA, for the 30-year period: Jan. 1951 - Dec. 1980. Here are presented results for the 90 fall months of Sept., Oct. and Nov. F.M.R.

N86-11807# Illinois Univ., Urbana.
LAND-SURFACE FLUCTUATIONS AND ASSOCIATED CLIMATIC VARIABILITY
John E. Walsh and William H. Jasperson (Control Data Corp., Minneapolis, Minn.) *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 326-330 (For primary document see N86-11763 02-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

Land surface effects are examined by constructing specification equations for the monthly surface station temperatures over the United States and Eurasia. These equations are obtained by forward stepwise screening of monthly grids of 700 mb height. Each equation is truncated according to a 1% F-test criterion. The 700 mb grids contain 91 points in the domains bounded by 20 deg N, 80 deg N, and either 50 deg W and 180 deg W (U.S.) or 0 deg E and 150 deg E (Eurasia). The 700 mb grids for 34 years (1947 to 1980, inclusive) are used in the analysis. Monthly air temperatures for the same 34 years are obtained for 61 stations in the U.S. and 231 stations in Eurasia. Missing Eurasian temperatures are obtained from the temperature anomalies at nearby stations. The snow data consists of monthly snow cover (2.5 cm and 15.0 cm) at eleven longitudes in the U.S. 120 deg W, 115 deg W, ..., 70 deg W. A monthly soil moisture index for each station is computed from monthly temperatures and precipitation amounts. F.M.R.

N86-11808# Creighton Univ., Omaha, Nebr. Dept. of Atmospheric Sciences.
CONCURRENT AND LAGGED RELATIONSHIPS BETWEEN PRECIPITATION FREQUENCY AND 700 MB HEIGHTS
Arthur V. Douglas and Phillip J. Englehart (Midwest Research Inst., Kansas City, Mo.) *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 331-340 (For primary document see N86-11763 02-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

Precipitation frequency and its relationship to 700 mb heights which shows little skewedness, especially in the arid West, are discussed. A data set of recipitation frequency for 60 divisions in the United States was developed. The new data set and its properties are described. Summer precipitation in two regions, the Southwest and the Central Plains, are reported. The pattern correlation between southwestern precipitation frequency in summer and 700mb height anomalies is given. If the summer data (frequency and 700mb) are recalculated using data from the normally wet months of July and August, stronger relationships become apparent. It is indicated that the June height data have little relationship with precipitation or subsequent height fields in July and August. If precipitation totals for the southwest region are related to 700mb heights instead of frequency, the observed correlation values tend to be lower, especially in the critical region of the central Rockies. E.A.K.

N86-11809# Colorado Univ., Boulder. Cooperative Inst. for Research in Environmental Sciences.
TROPICAL CONVECTION AND NORTH AMERICAN CYCLONES DURING THE 1982-83 EL NINO
Richard A. Keen *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 341-345 refs (For primary document see N86-11763 02-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

The planetary-scale wave pattern over North America responds to changes in the location and intensity of convection in the tropical Pacific. During El Nino conditions, convection shifts eastward into the central and eastern Pacific; the indicated mid-latitude response to this shift is the Pacific-North America, (PNA) pattern. One feature of the PNA pattern is an enhanced subtropical jet stream (STJ) across southern North America. During 1982 to 1983 jet stream wind velocities over the Gulf of Mexico were nearly twice their normal values. Such circulation anomalies are based on monthly or seasonal averages, and indicate the steady-state atmospheric response to persistent, large-scale tropical convection. E.A.K.

N86-11810# Massachusetts Inst. of Tech., Cambridge. Center for Meteorology and Physical Oceanography.
AN OBSERVATIONAL STUDY OF THE VERTICAL STRUCTURE OF INTERANNUAL WIND FLUCTUATIONS IN THE TROPICS
David S. Gutzler *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 346-351 refs (For primary document see N86-11763 02-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

Time series of rawinsonde-derived monthly mean winds were used to document and characterize the interannual variability of the tropical wind field with emphasis on the vertical structure of the observed fluctuations. Seasonal climatology was calculated and subtracted from season's observed wind to form time series of seasonal anomalies. Empirical orthogonal functions of the vertical structure of interannual variability were derived for each station and season for zonal and meridional wind components separately, by calculating the eigenvectors of a mass-weighted covariance matrix incorporating wind anomalies at all six levels. E.A.K.

N86-11811# Washington Univ., Seattle. Dept. of Atmospheric Sciences.
LOW-FREQUENCY BAROCLINIC FEATURES OBSERVED IN THE LEE OF MAJOR MOUNTAIN RANGES
Huang-Hsiung Hsu and John M. Wallace *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 352-359 refs (For primary document see N86-11763 02-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

The occurrence of the observed low-frequency variability which is inherently baroclinic in nature was addressed. The geographical dependence of the vertical structure of the geopotential height field was studied and indicated the existence of the baroclinic vertical structure on the cold or lee side of the major mountain ranges such as the Rockies and the Tibetan plateau in a wide frequency domain. The role of the highly baroclinic patterns playing in the low-frequency variability of the geopotential height field is examined. E.A.K.

N86-11812# Massachusetts Inst. of Tech., Cambridge. Dept. of Earth, Atmospheric and Planetary Science.

SLOW FLUCTUATIONS OF THE TROPICAL CIRCULATION DURING THE FGGE YEAR

Rennie Selkirk *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 360-372 (For primary document see N86-11763 02-47)

Avail: NTIS HC A19/MF A01 CSCL 04B

The fluctuations of the Walker circulation as reflected in the large scale divergent wind fields over the tropics and the subtropic during the FGGE Year are discussed. Empirical orthogonal function (EOF) analysis is used to resolve the largest spatial and largest time scale variations in the fields of velocity potential at the 850 and 200mb levels computed from the analyzed winds of the ECMWF FGGE III-b data set. The EOF results demonstrate that the 40 to 50 day time variations in both the Walker and Hadley cells are as important on the largest scale as the seasonal variability of the Hadley cell. E.A.K.

N86-11813# Maryland Univ., College Park. Dept. of Meteorology.

VERY ANOMALOUS BEHAVIOR OF OUTGOING LONGWAVE RADIATION IN THE TROPICS IN 1983-84: AFTERMATH OF ENSO?

Jay S. Winston *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 373-383 (For primary document see N86-11763 02-47)

(Grant NSF ATM-82-15090)

Avail: NTIS HC A19/MF A01 CSCL 04B

The extreme anomalies of the outgoing longwave radiation (OLR) over the tropical Pacific during the 1982 to 1983 ENSO event are discussed. As sea surface temperatures, the Southern Oscillation Index (SOI), and other features returned to more normal conditions in the second half of 1983, OLR anomalies in the tropics also became less extreme. By winter 1983 to 1984, however, strong OLR anomalies developed over the tropical Pacific and the Indian Ocean and generally persisted into spring 1984. These anomalies in tropical cloudiness and precipitation were accompanied by some pronounced anomalies of flow at 200 mb and 850 mb, but Pacific sea surface temperatures and the SOI exhibited values generally close to their normals. E.A.K.

N86-11814# World Meteorological Organization, Geneva (Switzerland). World Climate Programme Dept.

CLIMATE SYSTEM FLUCTUATIONS, MONITORING

S. Unninayar *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 384-397 refs (For primary document see N86-11763 02-47)

Avail: NTIS HC A19/MF A01 CSCL 04B

Climate fluctuations occur over a range of time scales and are associated with a magnitude of impact which are related to these time scales. The spatial extent of the phenomena seems linked with their temporal characteristics. The cause of past climate fluctuations is still a question. Theoretical and numerical modelling may be determining climate prediction. Advances in computer technology make it possible to process enormous volumes of observational data and integrate models of greater complexity. With the global deployment of satellite technology, observing systems have kept pace with the demand of models for more data, though in certain areas the availability of observations of certain variables/processes remains poor. An ideal global observing system could be implemented. The multidisciplinary nature of the atmosphere ocean cryosphere land surface climate system requires a mechanism that promotes a cross flow of information on the state of the system as a whole and on possible fluctuations that are of regional and global consequence. E.A.K.

N86-11815# National Environmental Satellite Service, Washington, D. C. Climate and Earth Sciences Lab.

THE STATUS OF THE NOAA/NESDIS RADIATION BUDGET DATA SET

Arnold Gruber *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 398-407 refs (For primary document see N86-11763 02-47)

Avail: NTIS HC A19/MF A01 CSCL 04B

Estimates of the planetary albedo and outgoing long wave radiation were obtained from polar orbiting operational spacecraft. Estimates of albedo and emitted radiation were produced from the TIROS-N series of satellites. Estimates of albedo were obtained from visible channel radiance and emitted flux were obtained from window channel measurements. Regression procedures are used to obtain the total broadband emitted flux from the window channel. The regression procedure was an empirical regression between simultaneous window data and broadband radiance observation from the Nimbus-7 ERB experiment. This is adopted as the most accurate equation for processing the data and previous calculations are adjusted to this new regression. E.A.K.

N86-11816# National Meteorological Center, Washington, D.C. Climate Analysis Center.

A SEA SURFACE TEMPERATURE ANALYSIS BASED ON IN SITU AND SATELLITE DATA

Richard W. Reynolds and William H. Gemmill *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 408-416 refs (For primary document see N86-11763 02-47)

Avail: NTIS HC A19/MF A01 CSCL 04B

The use of satellite data can significantly improve the surface temperature (SST) analysis. The monthly number of satellite SST retrievals over the globe are shown. These retrievals are obtained from the multichannel techniques using Advanced Very High Resolution Radiometer (AVHRR). The number of observations is much greater than the number of in situ observations and the satellite coverage is more uniform. The variation in the number of retrievals is due at times to satellite hardware problems but also to interpretation difficulties related to cloud cover and high level aerosols. It is reported that the aerosols introduced into the atmosphere by the El Chichon eruptions resulted in cold biases sometimes exceeding 2 C in the satellite SST retrievals relative to in situ reports. E.A.K.

N86-11817# Atmospheric and Environmental Research, Inc., Cambridge, Mass.

EFFECT OF INITIALIZATION ON DIAGNOSES OF LARGE-SCALE CIRCULATION STATISTICS FROM WMC ANALYSES

Richard D. Rosen and David A. Salstein *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 417-428 (For primary document see N86-11763 02-47)

(Contract NA-83SA-C-00738)

Avail: NTIS HC A19/MF A01 CSCL 04B

Analyses of the state of the atmosphere produced by operational weather concern are used in diagnostic studies of the large scale circulation. The degree to which these analyses may be compromised for this is analyzed to generate them. The effect of one element of the EMC global data assimilation system initialization on calculation of circulation statistics is examined. The only fields routinely archived and available to the scientific community are those that have undergone initialization. However, daily analyses made prior to the initialization step were used to examine differences between statistics generated from these preinitialized (PREI) analyses and the postinitialized (POSTI) ones. The results are generally more valid because the initialization scheme used by NMC remained unchanged during the entire period from about January 1981 through August 1984. E.A.K.

N86-11818# Texas A&M Univ., College Station. Dept. of Meteorology.

James P. McGuirk, Aylmer H. Thompson, and Neil R. Smith *In* NOAA Proc. of the 9th Ann. Climate Diagnostics Workshop Mar. 1985 p 429-436 (For primary document see N86-11763 02-47)

Avail: NTIS HC A19/MF A01 CSCL 04B

Aspects of the tropical Eastern Pacific mean meridional circulation are interpreted for the mean behavior of a synoptic event the moisture burst. Three different aspects of the interaction of moisture bursts and the Hadley cell are described: (1) the El Nino behavior; (2) mean meridional wind behavior; and (3) data quality. E.A.K.

N86-11819# National Weather Service, Silver Spring, Md.
MONTHLY AND SEASONAL WEATHER OUTLOOK FOR MAY 1985, VOLUME 39, NUMBER 9
30 Apr. 1985 10 p
(PB85-199123) Avail: NTIS HC A02/MF A01 CSCL 04B

Maps are given which contain observed and probability estimates of temperature and precipitation for October and November 1984 in the United States and Canada. GRA

N86-11820# National Oceanic and Atmospheric Administration, Washington, D. C. National Environmental Satellite, Data, and Information Service.
ATLAS OF HIGH ALTITUDE AIRCRAFT MEASURED RADIANCE OF WHITE SANDS, NEW MEXICO, IN THE 450-1050 NANOMETERS BAND
G. R. Smith, R. H. Levin, and J. S. Knoll Apr. 1985 34 p refs
(PB85-204501; NOAA-TR-NESDIS-20) Avail: NTIS HC A03/MF A01 CSCL 04B

The National Oceanic and Atmospheric Administration (NOAA) activity at White Sands, New Mexico was directed at providing visible wavelength calibration of Earth oriented satellite instruments. The best method of calibrating a satellite sensor is to make a simultaneous measurement with a calibrated instrument from a high altitude aircraft. Independent of the calibration, and as an interim product of data analysis, the aircraft instrument data is scientifically useful and is herein presented as an atlas of White Sands surface radiance. Author (GRA)

N86-11821# National Severe Storms Forecast Center, Kansas City, Mo.
MINIMUM ASSUMPTION TORNADO HAZARD PROBABILITY MODEL Final Technical Memo, 1950 - 1982
J. T. Schaefer, D. L. Kelly, and R. F. Abbey May 1985 40 p refs
(PB85-206092; NOAA-TM-NWS-NSSFC-8) Avail: NTIS HC A03/MF A01 CSCL 04B

One of the principle applications of climatological tornado data is in tornado hazard assessment. To perform such a hazard potential determination, historical tornado characteristics in either a regional or local area are compiled. A model is then used to determine a site specific point probability of a tornado greater than a specified intensity occurring. Various models require different climatological input. However, a knowledge of the mean values of tornado track length, tornado track width, tornado affected area, and tornado occurrence rate as both a function of tornado intensity and geographic area along with a violence frequency distribution enable most of the models to be applied. The NSSFC-NRC tornado data base is used to supply input for the determination of these parameters over the United States.
Author (GRA)

N86-11822# North American Weather Consultants, Inc., Salt Lake City, Utah.
CONTINUING DESIGN, REVIEW, AND ANALYSIS WORK FOR THE SIERRA COOPERATIVE PILOT PROJECT Final Report
R. D. Elliot, D. A. Griffith, John A. Flueck (Flueck Associates), and Jack F. Hannaford (Sierra Hydrotech, Placerville, Calif.) Nov. 1984 228 p refs
(Contract DI-7-07-83-V0008)
(PB85-204303; NAWC/SLWM-84-2) Avail: NTIS HC A11/MF A01 CSCL 04B

North America Weather Consultants (NAWC) supplied contractual support to the Bureau of Reclamation on their Sierra Cooperative Pilot Project (SCPP). The SCPP is an on-going winter weather modification research program being conducted in the central Sierra Nevada of California. This contractual work covered a 7-year period beginning in October 1977 and ending in September 1984. NAWC's objectives in the performance of this work were threefold: (1) complete the physical and statistical design of the SCPP, (2) review the project during its lifetime to insure that operations comply with the design, and (3) perform an unbiased evaluation of the seeding results. Author (GRA)

N86-11823# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Sciences Group.
AUTOMATED METHOD FOR THE DOCUMENTATION OF CLOUD-TOP CHARACTERISTICS OF MESOSCALE CONVECTIVE SYSTEMS
J. A. Augustine Feb. 1985 127 p
(PB85-204246; NOAA-TM-ERL-ESG-10) Avail: NTIS HC A07/MF A01 CSCL 04B

Measurements of cloud-top areas, centroid, and eccentricity for mesoscale convective systems (MCS's) were automated. The algorithm resides on the PROFS-2 VAX 11/780 computer and utilizes digital infrared imagery received at the local satellite ground station. The software is user-activated and processes one image per run. All operations are performed within the bounds of a user-defined image subsector. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N86-11824# Naval Postgraduate School, Monterey, Calif.
USE OF THE WAVENUMBER TECHNIQUE WITH THE LLOYDS MIRROR FOR AN ACOUSTIC DOUBLET M.S. Thesis
P. B. King Mar. 1985 113 p
(AD-A156463) Avail: NTIS HC A06/MF A01 CSCL 17/1

This thesis examines a method to determine the depth of a point source in an ocean environment. Using the Fourier Transform on the acoustic pressure field in the range domain results in the attainment of the acoustic pressure spectrum in the wave-number domain and a characteristic nodal spacing unique to the source-receiver depths. Quantitative examination of a magnitude plot of the spectrum and use of simple mathematical formulae yield the source depth. The debilitative effects of narrowband noise and surface roughness on the pressure spectrum is recognizable in noise after the pressure field in the range domain has been lost in the noise field. The effect of surface gravity waves on the pressure spectrum is similar to that on the pressure field in the range domain: the characteristic nodal spacing is suppressed as the height of the surface waves increases. Author (GRA)

N86-11825# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Environmental Lab.
USER GUIDE FOR WIFM-SAL (WES IMPLICIT FLOODING MODEL-SAL): A TWO-DIMENSIONAL VERTICALLY INTEGRATED, TIME-VARYING ESTUARINE TRANSPORT MODEL Final Report, Jul. 1979 - Jun. 1983
R. A. Schmalz, Jr. Mar. 1985 113 p
(AD-A157446; WES/IR/EL-85-1) Avail: NTIS HC A06/MF A01 CSCL 08/8

WIFM-SAL is preliminary to the development of comprehensive water quality mathematical models that may be used to assist in the analysis of water quality problems in shallow estuaries and embayments which may be considered vertically well mixed. The model is two dimensional in the horizontal and generates time-varying water surface elevations, velocities, and constituent fields over a space staggered grid. Units of measure are expressed in the English system (slug-ft-second). Results computed on a global grid may be employed as boundary conditions on a more spatially limited refined grid concentrated around the area of interest. In addition, the user may select either of two distinct transport schemes. Scheme 1 is a flux-corrected transport scheme capable of resolving sharp fronts without oscillation. Scheme 2 is a full, three time level scheme directly compatible with three level hydrodynamics. The telescoping grid capability in conjunction with the user selectable constituent transport scheme is an extremely powerful concept in real world transport problem solving. GRA

N86-11826# Coast Guard Research and Development Center, Groton, Conn.

AN EVALUATION OF CASP (COMPUTER ASSISTED SEARCH PLANNING PROGRAM) DRIFT PREDICTIONS NEAR THE NEW ENGLAND SHELF/SLOPE FRONT Interim Report
D. L. Murphy and A. A. Allen Jan. 1985 49 p
(AD-A157447; CGR/DC-7/85; USCG-D-16-85; IR-19) Avail: NTIS HC A03/MF A01 CSCL 06/7

In June 1984 a series of experiments was conducted in which the drift predictions of the Coast Guard's operational search planning computer model (CASP) were evaluated. Three satellite-tracked drift buoys and a life raft were released and tracked for two 3-day periods at the New England Shelf/Slope Front. Their movement was compared with CASP drift predictions for simulated PIW's and a life raft for two sets of environmental data: historical currents and large-scale winds versus locally measured data. For the historical data, the observed drift errors were two to four times larger than drift errors calculated by CASP. The use of on-scene environmental data improved the predictions for PIW's to near the CASP-calculated drift errors, but not for the life raft. Significant differences in the surface currents occurred over 20 nautical miles and 3 to 5 days, which were not accounted for by the historical surface current files, and therefore increased the error in the drift prediction of CASP. GRA

N86-11827# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
SURVEY OF ICE PROBLEM AREAS IN NAVIGABLE WATERWAYS
J. Zufelt and D. Calkins Apr. 1985 37 p
(AD-A157477; CRREL-SR-85-2) Avail: NTIS HC A03/MF A01 CSCL 13/2

This report presents the findings of a survey of ice problems encountered on the nation's major navigable waterways. A survey questionnaire was developed and, through a field review group, was distributed to lock and dam facilities on the Allegheny, Monongahela, Ohio, Kanawha, Kaskaskia, and Mississippi Rivers and the Illinois Waterway. Analysis of the completed questionnaires identified 13 ice problem categories. The report describes each category of ice problem encountered, as well as the cited methods, operational and/or structural, undertaken to reduce the impact of each ice problem. GRA

N86-11828# San Jose State Univ., Calif. Dept. of Geology.
CORAL REEF HYDROGEOLOGY
R. W. Buddemeier and J. A. Oberdorfer 21 May 1985 20 p refs Presented at the 5th Congr. Intern. Sur Les Recifs Coralliens, Rapeete, Tahiti, 27 May 1985
(Contract W-7405-eng-48)
(DE85-012923; UCRL-91772; CONF-8505162-1) Avail: NTIS HC A02/MF A01

Knowledge of internal flow velocities and pore water residence time is important in understanding pore water geochemistry, nutrient fluxes at the benthic boundary, reef diagenesis, and fresh water resources in reef islands. Hydrogeologic studies of Pacific and Indian Ocean reef and atoll islands indicate a dual aquifer systems; the major Pleistocene aquifer has hydraulic conductivities on the order of 1000 m/d, while the overlying Holocene aquifer of unconsolidated sediments is at least an order of magnitude less permeable. Studies of both submerged reefs and atoll islands give bulk pore water residence times on the order of months to a few years. Chemical analyses of pore water indicate that both carbonate solution and precipitation are taking place, which will alter porosity and permeability with time. The dual aquifer model also suggests that the Ghyben-Herzberg lens approach to reef island fresh water resources is inaccurate and can lead to a gross overestimation of the potable resource. DOE

N86-11551# Research Inst. of Geodesy, Prague (Czechoslovakia).
RESULTS OF KAPG CO-OPERATION IN EARTH TIDE RESEARCH
Zdenek Simon *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth 1985 p 24-30 refs (For primary document see N86-11549 02-42)
Avail: NTIS HC A09/MF A01

N86-11554# Hungarian Academy of Sciences, Scpron. Geodetical and Geophysical Research Inst.
HIGH FREQUENCIES IN TIDAL TILT RECORDS
G. Bartha *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth 1985 p 51-59 refs (For primary document see N86-11549 02-42)
Avail: NTIS HC A09/MF A01

N86-11558# Academy of Sciences, Potsdam (East Germany). Zentralinst. fuer Physik der Erde.
AN ATTEMPT TO DETECT GEOMETRIC TIDAL INFORMATION USING LAGEOS LASER RANGING DATA
R. Dietrich and G. Gendt *In its* Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth 1985 p 77-81 refs (For primary document see N86-11549 02-42)
Avail: NTIS HC A09/MF A01

N86-11571# Freie Univ., Berlin (West Germany). Inst. fuer Geophysikalische Wissenschaften.
OCEAN TIDAL LOADING ALONG THE BLUE ROAD GEOTRAVERSE IN FENNOSCANDIA
Gerhard Jentzsch *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 2 1985 p 18-28 refs (For primary document see N86-11568 02-42)
Avail: NTIS HC A09/MF A01

N86-11576# Belgian Royal Observatory, Uccle.
INTERACTIONS BETWEEN OCEANIC AND GRAVITY TIDES, AS ANALYSED FROM WORLD-WIDE EARTH TIDE OBSERVATIONS AND OCEAN MODELS
P. Melchior, B. Ducarme, M. VanRuymbeke, C. Poitevin, and M. DeBecker *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 2 1985 p 55-62 refs (For primary document see N86-11568 02-42)
Avail: NTIS HC A09/MF A01

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N86-11829*# Wisconsin Univ., Madison. Dept. of Horticulture.
CONTROLLED ENVIRONMENT LIFE SUPPORT SYSTEM: CALCIUM-RELATED LEAF INJURIES ON PLANTS Final Report, May 1981 - Apr. 1984
T. W. Tibbitts 1985 44 p refs
(Contract NCC2-136)
(NASA-CR-176288; NAS 1.26:176288) Avail: NTIS HC A03/MF A01 CSCL 06C

A calcium related injury in lettuce termed tipburn was the focus of this study. It affects the young developing leaves as they become enclosed during head formation. It is a good model system to study because the injury can be induced with good predictability and lettuce is one of the crops chosen by the CELSS program for concentrated study. Investigations were undertaken to study a number of different procedures, that would have the potential for encouraging movement of calcium into the young developing leaves and to study the time course and pattern of calcium accumulation in developing leaves to provide a basis for developing effective control procedures for this injury. Author

N86-11830*# Massachusetts Inst. of Tech., Cambridge. Dept. of Applied Biological Science.
UTILIZATION OF NON-CONVENTIONAL SYSTEMS FOR CONVERSION OF BIOMASS TO FOOD COMPONENTS: POTENTIAL FOR UTILIZATION OF ALGAE IN ENGINEERED FOODS Annual Report
M. Karel, A. R. Kamarei, and Z. Nakhost Mar. 1985 37 p refs
(Contract NCC2-231)
(NASA-CR-176257; NAS 1.26:176257) Avail: NTIS HC A03/MF A01 CSCL 06C

The major nutritional components of the green algae (Scenedesmus obliquus) grown in a Constant Cell density Apparatus were

determined. Suitable methodology to prepare proteins from which three major undesirable components of these cells (i.e., cell walls, nucleic acids, and pigments) were either removed or substantially reduced was developed. Results showed that processing of green algae to protein isolate enhances its potential nutritional and organoleptic acceptability as a diet component in a Controlled Ecological Life Support System. Author

N86-11831*# San Francisco Univ., Calif.
STRUCTURE AND FUNCTION OF ISOZYMES: EVOLUTIONARY ASPECTS AND ROLE OF OXYGEN IN EUCARYOTIC ORGANISMS Final Report
Tanjore Satyanarayana Sep. 1985 11 p refs
(Contract NCC2-85)
(NASA-CR-176296; NAS 1.26:176286) Avail: NTIS HC A02/MF A01 CSCL 06C

Oxygen is not only one of the most abundant elements on the Earth, but it is also one of the most important elements for life. In terms of composition, the feature of the atmosphere that most distinguishes Earth from other planets is the presence of abundant amounts of oxygen. The first forms of life may have been similar to present day anaerobic bacteria such as clostridium. The relationship between prokaryotes and eukaryotes, if any, has been a topic of much speculation. With only a few exceptions eukaryotes are oxygen-utilizing organisms. This research eukaryotes or eukaryotic biochemical processes requiring oxygen, could have arisen quite early in evolution and utilized the small quantities of photocatalytically produced oxygen which are thought to have been present on the Earth prior to the evolution of massive amounts of photosynthetically-produced oxygen. B.W.

N86-11832# Army Research Inst. of Environmental Medicine, Natick, Mass.
AN ATROPINIZED HEAT-STRESSED RAT MODEL: ANTICHOLINERGIC AND ANTICHOLINESTERASE DRUG POTENCY
C. B. Matthew, R. W. Hubbard, and R. P. Francesconi Jul. 1985 18 p
(DA Proj. 3M1-62734-A-875)
(AD-A157620; USARIEM-M-34/85) Avail: NTIS HC A02/MF A01 CSCL 06/15

We have developed an animal model to evaluate the thermoregulatory effects of several anticholinergic drugs, particularly in hot environments. Our previous work on this model demonstrated that atropine, the prototype of muscarinic anticholinergic drugs, produces a dose-dependent increase in heating rate of heat-stressed rats that lasted for 3 hours after administration. By comparing the effects on heating rate of other anticholinergic drugs relative to the effects of atropine, we derived the following potency ratios: imipramine (0.004), amitriptyline (0.02), chlorpromazine (0.1), atropine (1); L-hyoscymaine (2), atropine methyl nitrate (4), and scopolamine (16). Additionally, we tested the ability of carbamates to reduce the elevated heating rate of atropinized rats as a measure of anticholinesterase efficacy, resulting in the following relative potencies: neostigmine (8), physostigmine (2) and pyridostigmine (1). Our results indicate that this is a useful model to evaluate potential drug-exacerbated increases in body temperature in hot environments. GRA

N86-11833# Oak Ridge National Lab., Tenn.
POSITIVE GENETIC HAZARD PREDICTIONS FROM SHORT-TERM TESTS HAVE PROVED FALSE FOR RESULTS IN MAMMALIAN SPERMATOGONIA WITH ALL ENVIRONMENTAL CHEMICALS SO FAR TESTED
W. L. Russell 1985 9 p refs Presented at the 4th Intern. Conf. on Environ. Mutagens, Stockholm, 24 Jun. 1985
(Contract DE-AC05-84OR-21400)
(DE85-013640; CONF-8506137-1) Avail: NTIS HC A02/MF A01

Eleven chemicals for which there has been considerable human exposure were studied by the mouse specific-locus method because of their positive mutagenic action in other test systems. All were positive in the Drosophila sex-linked recessive lethal test, and in mammalian somatic cells proved muagenic. In mouse stem-cell spermatogonia none of the chemicals, even at maximum tolerated dose, has given a specific-locus mutation frequency higher than the control, and the mutation frequency for all eleven combined (12 mutations in 298,502 offspring) was actually less than the historical control. Absence of mutation induction cannot be attributed to: (1) failure of the chemicals to reach the testis (10 of them are known to reach the testis in active form), (2) small sample size (the samples are large), and (3) insensitivity of the test (the test is not insensitive, a positive control gave a mutation frequency 132 times higher than the historical control). It is concluded that mammalian stem-cell spermatogonia have an effective repair capability. DOE

N86-11834# California Univ., Livermore. Lawrence Livermore Lab.
DETECTION OF CHROMOSOMAL ABNORMALITIES IN HUMAN SPERM
B. Brandriff, L. Gordon, A. K. Ashworth, G. Watchmaker, and A. V. Carrano 19 Jun. 1985 9 p refs Presented at the 4th Intern. Conf. on Environ. Mutgens, Stockholm, 24 Jun. 1985
(Contract W-7405-eng-48)
(DE85-014178; UCRL-92835; CONF-8506137-3) Avail: NTIS HC A02/MF A01

A new technology developed by Rudak, et al., for examining the chromosomal constitution of human sperm through fusion with eggs from the Syrian hamster was used to obtain baseline data on the types and frequencies of aberrations in sperm of normal men. The frequency of structural aberrations in 2724 sperm chromosome karyotypes from the 13 healthy non-exposed donors ranged from 2 to 15.8%, demonstrating significant interindividual variability. The most frequently occurring aberrations were chromosome breaks, followed by acentric fragments, chromatid exchanges, chromatid breaks, dicentrics and translocations, chromosome deletions and duplications, inversions, and chromatid deletions. Two donors previously reported had one cell each with multiple chromatid exchanges and breaks. In addition, the oldest donor, AA, had 5 cells out of 124 examined with multiple breaks and rearrangements too extensive to completely identify. DOE

N86-11835# Oak Ridge National Lab., Tenn.
RELATIONSHIP BETWEEN ALKYLATION SITES AND INDUCTION OF DOMINANT LETHALS AND HERITABLE TRANSLOCATIONS IN MICE
W. M. Generoso 1985 8 p refs Presented at the 4th Intern. Conf. on Environ. Mutagens, Stockholm, 24 Jun. 1985
(Contract DE-AC05-84OR-21400)
(DE85-014309; CONF-8506137-6) Avail: NTIS HC A02/MF A01

Production of dominant lethals and heritable translocations is determined by the degree of stability of alkylation products within the chromosome. If repair is not effected in the fertilized eggs and the alkylation products persist to the time of pronuclear chromosome replication or early cleavage divisions, they lead to chromatid-type aberrations and eventually to lethality. The production of heritable translocations requires a transformation of unstable alkylation products into suitable intermediate lesions. These lesions are converted into chromosome exchanges prior to the time of pronuclear chromosome replication. Dominant lethals result from both chromatid and chromosome-type aberrations while heritable translocations results primarily from the latter type. It is inherent that the production of chromosome and chromatid-type aberrations by a chemical mutagen are not necessarily mutually exclusive. E.A.K.

N86-11836# Oak Ridge National Lab., Tenn.
INFORMATION FROM SPECIFIC-LOCUS MUTANTS ON THE NATURE OF INDUCED AND SPONTANEOUS MUTATIONS IN THE MOUSE
L. B. Russell 1985 12 p refs Presented at 4th Intern. Conf. on Environ. Mutagens, Stockholm, 24 Jun. 1985
(DE85-014313; CONF-8506123-7) Avail: NTIS HC A02/MF A01

Genetic and molecular analyses of mutations are increasing the qualitative capabilities of the specific-locus test (SLT). Some mutations are found to be deletions of large numbers of genes,

including some that control survival at various developmental stages, neurological functions, enzyme syntheses, etc. Smaller (including possibly single-gene) deletions are also detected. A third group of SLT mutations represents intragenic lesions. For at least three of the loci, mutations may now be qualitatively grouped on the basis of simple phenotypic findings. Type of mutagen and germ-cell stage exposed strongly influence the nature of the lesions. The qualitative information from SLT results makes possible conclusions about relative potential harmfulness of different types of exposures that may yield equal mutation rates, about difference between induced and spontaneous mutations, etc. It also identifies genetic material suitable for basic studies. DOE

N86-11837# Tulsa Univ., Okla.
TERATOGENIC EFFECTS OF MICROWAVE RADIATION Final Report, 1980 - 1985
M. E. OConnor and R. Strattan May 1985 51 p
(Contract EPA-68-02-3453)
(PB85-207462; EPA-600/1-85-007) Avail: NTIS HC A04/MF A01 CSCL 06T

Pregnant CF-1 mice was exposed to 2450-MHz CW microwave irradiation at power densities of 0, 10, or 30 mW/sq. cm for 6 hours daily from gestational day 1 through day 18. All exposures occurred in an anechoic chamber maintained at 50% relative humidity with air temperature of 22C. A group of pregnant colon cage-control mice was maintained for each of the three exposure groups. Teratogenic examinations were performed on day 18 following Caesarean section of the maternal subject. Every third fetus was stained with alazarin red and examined for skeletal abnormalities. No significant differences between the groups observed for fetal body mass, fetal brain mass, resorption, live fetuses, gross abnormalities, or skeletal abnormalities. Author (GRA)

52 AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and weightlessness.

N86-11838*# Rhode Island Univ., Kingston. Dept. of Physics.
FIBER OPTIC PRESSURE SENSORS IN SKIN-FRICTION MEASUREMENTS Final Report
Robert Kidwell Sep. 1985 57 p refs
(Grant NAG1-519)
(NASA-CR-176294; NAS 1.26:176294) Avail: NTIS HC A04/MF A01 CSCL 06B

Fiber optic lever pressure sensors intended for use in a low speed wind tunnel environment were designed, constructed and tested for the measurement of normal and shear displacements associated with the pressures acting on a flat aluminum plate. On-site tests performed along with several static and dynamic measurements made have established that, with proper modifications and improvements, the design concepts are acceptable and can be utilized for their intended use. Several elastomers were investigated for use in sensors and for their incorporation into these sensors. Design and assembly techniques for probes and complete sensors were developed. Author

N86-11839# American Inst. of Biological Sciences, Arlington, Va.
ASSESSMENTS AND VIEWPOINTS ON THE BIOLOGICAL AND HUMAN HEALTH EFFECTS OF EXTREMELY LOW FREQUENCY (ELF) ELECTROMAGNETIC FIELDS: COMPILATION OF COMMISSIONED PAPERS FOR THE ELF LITERATURE REVIEW PROJECT Final Report
May 1985 469 p
(Contract N00014-84-C-0446)
(AD-A156942) Avail: NTIS HC A20/MF A01 CSCL 06/18

The biological and human health effects of extremely low frequency (ELF) electromagnetic fields are discussed. Among the topics discussed are: The effects of ELF fields on neural development and nerve regeneration; electromagnetic fields and calcium efflux; studies of plants and animals exposed to ELF electric and magnetic fields; electromagnetic influences on birds; a review of Cell Effects Induced by Exposure of Extremely Low Frequency electromagnetic fields; the effects of ELF electric and magnetic fields on artificial cardiac pacemakers; behavioral toxicology of ELF electric and magnetic fields; electromagnetic fields and public health; influence of power frequency electric and magnetic fields on human health; ecological effects of extremely low frequency electric and magnetic fields; reproductive and developmental alterations associated with exposure of mammals to ELF (1 to 300 Hz) electromagnetic fields; behavioral effects extremely low frequency electric and magnetic fields; effects of electromagnetic fields on circadian rhythms; effects of ELF electromagnetic fields on neuroendocrine systems; immunological effects of extremely low frequency electromagnetic fields; neural effects of extremely low frequency fields as a function of induced tissue current density; magnetic and electromagnetic field effects on biological systems; and effects of extremely low frequency electric and magnetic fields on the nervous system are discussed. GRA

N86-11840# Army Research Inst. of Environmental Medicine, Natick, Mass.
PERCEPTUAL AND PHYSIOLOGICAL RESPONSES DURING EXERCISE IN COOL AND COLD WATER
M. M. Toner, L. L. Drolet, and K. B. Pandolf Jun. 1985 23 p
(DA Proj. 3E1-62777-A-879)
(AD-A157334; USARIEM-M-32/85) Avail: NTIS HC A02/MF A01 CSCL 06/19

This investigation examined the interaction of exposure to cold water stress with both perceived exertion and thermal sensation (TS) during exercise. Eight male volunteers performed arm, leg and combined arm and leg exercise for 45 min in water at 20 and 26 C. Exercise was performed at a low and a high intensity relative to the ergometer specific peak oxygen uptake (VO2 peak). In general, percent VO2 peak did not differ ($p > 0.05$) between types of exercise in either 20 or 26 C water. During low intensity exercise when power output was matched across water temperatures (Tw), percent VO2 peak was greater ($p < 0.05$) in 20 C water (52%) compared to 26 C water (42%). Ratings of perceived exertion (RPE) did not differ ($p > 0.05$) between Tw. During high intensity exercise when percent VO2 peak was matched across Tw, RPE was lower during exercise in 20 C compared to 26 C. Multiple correlation analyses comparing both final RPE and thermal sensation with physiological and thermal measures were performed across type of exercise and Tw. RPE was moderately correlated with heart rate and ventilation, whereas very slight relationships were established with TS, skin and rectal temperatures. TS was moderately correlated with skin and rectal temperatures whereas low correlations existed between TS and both heart rate and ventilation. These data suggest that the change in oxygen uptake associated with exercise in cold water does not add to the overall perception of exertion. This perception appears to be related to cardiopulmonary variables rather than thermal measures, whereas thermal sensation is related to thermal measures and not cardiopulmonary variables. GRA

N86-11841# Army Research Inst. of Environmental Medicine, Natick, Mass.
PHYSIOLOGICAL EFFECTS OF TRAINING
W. J. Kraemer and W. L. Daniels 25 Jun. 1985 44 p
(AD-A157417; USARIEM-M-31/85) Avail: NTIS HC A03/MF A01 CSCL 06/16

With the evolution of exercise science a vast amount of information concerning the physiological effects of training has been generated. Understanding the basic training responses and adaptations of various modes of conditioning can give the clinician insights into exercise prescription. The purpose of this manuscript is not to present an exhaustive review, but provide the reader with a basic overview of the physiological effects of training. Aerobic training results in a number of adaptations in humans. The magnitude of this response is dependent upon a number of factors. It depends upon the type, the intensity, the frequency and the duration of the training; as well as the characteristics of the person undergoing training. In this section, we will discuss the physiologi-

cal changes associated with the adaptation to training and how the characteristics of the individual and the training itself affect this adaptation. GRA

N86-11842# Oregon Univ., Eugene. Dept. of Psychology.
IS THE CEREBELLUM INVOLVED IN MOTOR AND PERCEPTUAL TIMING: A CASE STUDY Final Report
S. W. Keele, D. L. Manchester, and R. D. Rafal 15 May 1985 21 p
(Contract N00014-83-K-0601)
(AD-A157452; TR-85-5-ONR) Avail: NTIS HC A02/MF A01 CSCL 06/16

A model and a technique developed by Wing and Kristofferson (1973) decomposes variance of timing into that putatively due to a central timekeeper (a clock) and that due to implementation of movement through the motor system. A patient with unilateral cerebellar damage, when attempting to tap out a regular series of intervals, showed a large increase in timing variability for the left hand compared to the right hand at target intervals of 550 msec. Application of the model suggested the increased variability was in the clock. Moreover, the patient appeared to have greater than normal difficulty in discriminating the durations of auditorially based time intervals. Earlier work (Wing, Keele, and Margolin, 1984) had suggested that basal ganglia damage in a Parkinson's patient also manifested itself as a clock disorder. The suggestion that clock variability arises from two different sources leads us to speculate that the brain's clock involves a circuit between several brain systems. These speculations are quite tentative because of interpretive problems with some of the data. GRA

N86-11843# Oregon Univ., Eugene. Dept. of Psychology.
FORCE AND TIMING COMPONENTS OF THE MOTOR PROGRAM Final Report
R. B. Ivry 15 May 1985 55 p
(Contract N00014-83-K-0601)
(AD-A157584; TR-85-3-ONR) Avail: NTIS HC A04/MF A01 CSCL 05/10

Three experiments assess the effects of variations of force and time on response latency on both simple and choice reaction time. The first two experiments demonstrate that, while latency does not vary as a function of force, increasing timing demands by requiring that a response be maintained led to increases in reaction time. These results led to the development of a model of motor programming in which force and timing are dissociated as separate components. However, the data also indicated that the force component may be further analyzed into two subcomponents: force activation and force deactivation. The model predicts that the latter subcomponent may be programmed on-line provided sufficient time elapses between the implementation of the two subcomponents. The results of Experiment 3 support this prediction and further validate the proposed model. GRA

N86-11844# Army Environmental Hygiene Agency, Aberdeen Proving Ground, Md.
HEALTH HAZARD EVALUATION OF LIQUID MONOPROPELLANTS. PHASE 4. SUBCHRONIC INHALATION OF HYDROXYLAMMONIUM NITRATE, JANUARY 1985
19 Jul. 1985 24 p
(AD-A157623; USAEHA-75-51-0132-85) Avail: NTIS HC A02/MF A01 CSCL 06/20

This study was conducted to determine the effects of repeated airborne exposures to animals of hydroxylammonium nitrate (HAN), a major component of liquid gun propellants. This evaluation will assist in advising on the potential health risks associated with handling these materials. Rats and dogs were exposed to aerosolized HAN for 90 days at concentrations of 300, 100, and 33 mg/cu m. Dose-related effects occurred in both species and were characterized in rats by weight loss and spleen and liver enlargement. In dogs, respiratory irritation and blood dyscrasia were the major toxic effects. Minimal effects were observed at the low dose, 33 mg/cu m. Personnel should be protected against all routes of HAN exposure since the systemic effects are additive. An airborne concentration of HAN at 3 mg/cu m may be considered as a basis for the development of a maximum allowable workplace atmosphere. Accidental exposures in man should be closely monitored for cyanosis, anemia and respiratory distress. Treatment for methemoglobinemia may be indicated. GRA

N86-11845# Pacific Northwest Lab., Richland, Wash.
DOSE DISTRIBUTION AND THE RELATIVE BIOLOGICAL EFFECTIVENESS OF INTERNAL ALPHA EMITTERS
D. R. Fisher, M. E. Frazier, and T. K. Andrews, Jr. Mar. 1985 15 p refs Presented at the 9th Symp. on Microdosimetry, Toulouse, 20 May 1985
(Contract DE-AC06-76RL-01380)
(DE85-013041; PNL-SA-12638; CONF-850506-9) Avail: NTIS HC A02/MF A01

The influence of dose distribution at the cellular level on the relative biological effectiveness of internally deposited alpha-particle emitters were examined. Cultured Chinese Hamster Ovary (CHO-K1) cells were irradiated in vitro by insoluble ceramic microspheres of zirconium oxide labeled with (239)Pu. The absorbed dose and dose rate were held constant at 0.7 Gy and 0.17 Gy h(-1), respectively. Relative biological effectiveness (RBE) was evaluated using three endpoints: initial cell survival, mutation frequency, and primary DNA damage. Cell death was greatest for irradiations by sources of low specific activity. Mutation frequency was greatest for cells exposed to agitated sources and least for irradiation by stationary high-specific-activity sources. The amount of DNA damage increased at the alpha radiation was more uniformly distributed amongst the cells at risk. DOE

N86-11846# Brookhaven National Lab., Upton, N. Y.
THYROID ABSORBED DOSE FOR PEOPLE AT RONGELAP, UTIRIK AND SIFO ON MARCH 1, 1954
E. T. Lessard, R. P. Miltenberger, R. A. Conrad, S. V. Musoline, J. R. Naidu, A. Moorthy, and C. J. Schopfer Mar. 1985 84 p refs
(Contract DE-AC02-76CH-00016)
(DE85-014695; BNL-51882) Avail: NTIS HC A05/MF A01

A study was undertaken to reexamine thyroid absorbed dose estimates for people accidentally exposed to fallout at Rongelap, Sifo, and Utirik Islands from the Pacific weapon test known as Operation Castle BRAVO. The study included: (1) reevaluation of radiochemical analysis, to relate results from pooled urine to intake, retention, and excretion functions; (2) analysis of neutron-irradiation studies of archival soil samples, to estimate areal activities of the iodine isotopes; (3) analysis of source term, weather data, and meteorological functions used in predicting atmospheric diffusion and fallout deposition, to estimate airborne concentrations of the iodine isotopes; and (4) reevaluation of radioactive fallout, which contaminated a Japanese fishing vessel in the vicinity of Rongelap Island on March 1, 1954, to determine fallout components. The conclusions of the acute exposure study were that the population mean thyroid absorbed doses were 21 gray (2100 rad) at Rongelap, 6.7 gray (670 rad) at Sifo, and 2.8 gray (280 rad) at Utirik. The overall thyroid cancer risk we estimated was in agreement with results published on the Japanese exposed at Nagasaki and Hiroshima. The major route for intake of fallout was by direct ingestion of food prepared and consumed outdoors. DOE

N86-11847# California Univ., Livermore. Lawrence Livermore Lab.
PROSPECTS FOR DNA METHODS TO MEASURE HUMAN HERITABLE MUTATION RATES
M. L. Mendelsohn 14 Jun. 1985 9 p Presented at the 4th Intern. Conf. on Environ. Mutagens, Stockholm, 24 Jun. 1985
(Contract W-7405-eng-48)
(DE85-014555; UCRL-92242; CONF-8506137-5) Avail: NTIS HC A02/MF A01

A workshop cosponsored by ICPEMC and the US Department of Energy was held in Alta, Utah, December 9 to 13, 1984 to examine the extent to which DNA-oriented methods might provide new approaches to the important but intractable problem of measuring mutation rates in control and exposed human popula-

tions. The workshop identified and analyzed six DNA methods for detection of human heritable mutation, including several created at the meeting, and concluded that none of the methods combine sufficient feasibility and efficiency to be recommended for general application. DOE

N86-11848# Maryland Univ., Baltimore.
ACUTE PULMONARY EFFECTS OF FORMALDEHYDE EXPOSURE IN HUMANS Progress Report, 1 Dec. 1983 - 30 Nov. 1984
Jul. 1985 6 p refs
(Contract DE-AS05-84ER-60192)
(DE85-014728; DOE/ER-60192/1) Avail: NTIS HC A02/MF A01

Nonsmoking subjects were randomly exposed at rest for 3 hours each to 0.0, 0.5, 1.0, and 2.0 ppM HCHO for establishing a dose-response curve at rest, and the effect of 2 ppM HCHO with moderate exercise with a 24-hr postexposure was evaluated. Results of exposure of the 10 subjects to the concentration are: (1) a significant or near significant decrease, compared to clean air; (2) the FVC and FEV1 time courses of response showed no clear change in function over any 3-hour exposure from 0.0 to 2.0 ppM HCHO; and (3) including the 2.0 ppM HCHO exposure only mild symptoms were experienced. DOE

N86-11849# Oak Ridge National Lab., Tenn.
IMPROVEMENT IN WEAR PERFORMANCE OF SURGICAL TI-6AI-4V ALLOY BY ION IMPLANTATION OF NITROGEN OR CARBON
J. M. Williams, R. A. Buchanan, and E. D. Rigney, Jr. Jun. 1985 10 p refs Presented at the Am. Soc. for Met. Conf. on the Appl. of Ion Plating and Implantation to Mater., Atlanta, 3 Jun. 1985 Prepared in cooperation with Alabama Univ., Birmingham
(Contract DE-AC05-84OR-21400)
(DE85-013986; CONF-8506139-1) Avail: NTIS HC A02/MF A01

The effects of ion implantations of either nitrogen or carbon on the corrosive wear performance of surgical Ti-6Al-4V alloy were investigated. In vitro tests made use of an apparatus which could produce certain chemical and mechanical aspects of a sliding interface such as that which occurs between alloy and polyethylene components of an artificial hip (or knee) joint. Cylindrical samples of the Ti alloy were rotated between loaded, conforming pads made of ultrahigh molecular weight polyethylene (UHMWPE) while these test components were immersed either in a saline solution or a saline solution with bovine serum added. During the tests open circuit corrosion currents for the alloy were measured by the Tafel extrapolation technique. Profilometry studies were done before and after the tests. Alloy samples implanted with either nitrogen or carbon remained as new for all test conditions. Unimplanted control samples were severely scored. Corrosion currents as measured under the mechanical action were reduced by a factor of approximately one hundred by the ion implantation treatments. DOE

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N86-11850*# Old Dominion Univ., Norfolk, Va. Dept. of Psychology.
VISUAL INFORMATION TRANSFER. PART 1: ASSESSMENT OF SPECIFIC INFORMATION NEEDS. PART 2: PARAMETERS OF APPROPRIATE INSTRUMENT SCANNING BEHAVIOR Progress Report, 15 Feb. - 15 Oct. 1985
J. Raymond Comstock, Jr., Raymond H. Kirby, and Glynn D. Coates Oct. 1985 11 p refs
(Grant NAG1-451)
(NASA-CR-176277; NAS 1.26:176277) Avail: NTIS HC A02/MF A01

The present study explored eye scan behavior as a function of level of subject training. Oculometric (eye scan) measures were recorded from each of ten subjects during training trials on a CRT based flight simulation task. The task developed for the study incorporated subtasks representative of specific activities performed by pilots, but which could be performed at asymptotic levels within relatively short periods of training. Changes in eye scan behavior were examined as initially untrained subjects developed skill in the task. Eye scan predictors of performance on the task were found. Examination of eye scan in proximity to selected task events revealed differences in the distribution of looks at the instruments as a function of level of training. Author

N86-11851# Pennsylvania State Univ., University Park. Dept. of Psychology.
ADAPTIVE MOTIVATION THEORY Final Report
F. J. Landy and W. S. Becker Jun. 1985 69 p
(Contract N00014-81-K-0197)
(AD-A157440; Rept-85-1) Avail: NTIS HC A04/MF A01 CSCL 05/10

Traditional approaches to understanding motivation have not been successful. Middle range theories are necessary for progress in this area. Cognitive processes will play a major role in motivation theories of the future. Various middle range theories are likely to be more suitable for understanding some dependent variables than others. The work on adaptive motivation theory was intended to be preliminary, exploring the possible advantages of a reconceptualization of motivation theory. In this report, we see our goal as introducing some lines of speculation, sampling some recent research that gives rise to that speculation, and presenting specimens of new theory and research designs and, ultimately, persuading the reader to pick up the burden of a novel idea or approach and to carry it some distance for us. Various technical and quarterly reports have detailed the development of questionnaires and methods of measuring components of adaptive motivation theory. In this report, we identify the nature and extent of that conceptual work. In effect, we suggest that it may be valuable to explore more deeply the cognitive roots of many of the current approaches. Through such an exploration, it may be possible to develop a set of middle range theories capable, in aggregate, of explaining motivated behavior. GRA

N86-11852# Oregon Univ., Eugene. Dept. of Psychology.
COGNITIVE SCIENCE PROGRAM: DISSOCIATION OF THE CENTRAL TIMEKEEPER AND THE PERIPHERAL IMPLEMENTATION PROCESSES IN REPETITIVE MOVEMENTS Final Technical Report
R. B. Ivry and S. W. Keele 15 May 1985 23 p
(Contract N00014-83-K-0601)
(AD-A157542; TR-85-7-ONR) Avail: NTIS HC A02/MF A01 CSCL 06/5

Wing and Kristofferson (1973) have proposed a two-stage model of timing in repetitive motor behavior which assumes independence of a central timekeeper process and the peripheral implementation system. This model was tested with a patient who has incurred a peripheral motor neuropathy. The patient's inconsistent performance in a periodic tapping task with the afflicted hand was found to be attributable to increased variability in the motor implementation process only. This report, in conjunction with the previous study of Wing et al., (1984) in which a Parkinsonian patient was found to have a timekeeper deficit, provides a double dissociation of the timekeeper and implementation processes. Thus, the independence assumption of the Wing and Kristofferson model is supported. GRA

N86-11853# California Univ., Livermore. Lawrence Livermore Lab.
PSYCHOLOGICAL ASPECTS OF PERSONNEL CONTAMINATION
R. L. Wilson Apr. 1985 7 p ref Presented at the Hazardous Mater. Conf., Oakland, Calif., 23 Apr. 1985
(Contract W-7405-eng-48)
(DE85-012955; UCRL-92501; CONF-8504140-1) Avail: NTIS HC A02/MF A01

This paper discusses some of the major emotional considerations involved in the treatment of people who have been contaminated with potentially hazardous materials. Although the principal focus is the treatment of people trained to work with these materials, an attempt is also made to extend these methods to people having little or no knowledge of such matters. Accidents always result in emotional trauma. When the accident involves radioactive or other potentially toxic, carcinogenic, or mutagenic materials, there is a possibility of enhanced emotional stress due to the mystique surrounding these substances. Several psychological principles that have emerged from the treatment of radioactively contaminated workers are: (1) provide preaccident training for all radiation workers; (2) avoid secrets; (3) as rapidly as possible following a contamination accident, bring the worker into contact with others; (4) recognize the emotions of the family and the family's fears and trauma; and (5) do not desert the worker after decontamination has been completed. DOE

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N86-11854*# Martin Marietta Aerospace, Denver, Colo.
TELEOPERATOR HUMAN FACTORS STUDY Progress Report, 7 Sep. - 6 Oct. 1985
K. Z. Bradford and R. T. Schappell Oct. 1985 6 p
(Contract NAS8-35184)
(NASA-CR-176310; NAS 1.26:176310; MCR-83-607) Avail: NTIS HC A02/MF A01 CSCL 05H

The progress made on the Teleoperator Human Factors Study program during the period of September 7, 1985 to October 6, 1985 is discussed. Technical and programmatic problems that were encountered are discussed along with activity planned for the following month. The main portion of the report has been separated into four sections: Work Performed, Future Work, Problems Encountered, and Cost Information. G.L.C.

N86-11855# Oak Ridge National Lab., Tenn.
MECHANICAL ACCESSORIES FOR MOBILE TELEOPERATORS
M. J. Feldman and J. N. Herndon 1985 19 p Presented at the Workshop on Requirements of Mobile Teleoperators for Radiol. Emergency Response and Recovery, Dallas, 23 Jun. 1985
(Contract DE-AC05-84OR-21400)
(DE85-014310; CONF-8506148-2) Avail: NTIS HC A02/MF A01

The choice of optimum mechanical accessories for mobile teleoperators involves matching the criteria for emergency response with the available technology. A general background is presented to teleoperations, a potpourri of the manipulator systems available, and an argument for force reflecting manipulation. The theme presented is that the accomplishment of humanlike endeavors in hostile environments will be most successful when man model capabilities are utilized. The application of recent electronic technology to manipulator development has made new tools available to be applied to emergency response activities. The development activities described are products of the Consolidated Fuel Reprocessing Program at the Oak Ridge National Laboratory. DOE

55 PLANETARY BIOLOGY

Includes exobiology; and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

N86-11856*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
TOWARDS DEVELOPING ROBUST ALGORITHMS FOR SOLVING PARTIAL DIFFERENTIAL EQUATIONS ON MIMD MACHINES Final Report
Joel H. Saltz and Vijay K. Naik Sep. 1985 53 p refs Submitted for publication
(Contract NAS1-17070; Grants NAG1-466; NIH-HL-11307)
(NASA-CR-177979; ICASE-85-39; NAS 1.26:177979) Avail: NTIS HC A04/MF A01 CSCL 12A

Methods for efficient computation of numerical algorithms on a wide variety of MIMD machines are proposed. These techniques reorganize the data dependency patterns to improve the processor utilization. The model problem finds the time-accurate solution to a parabolic partial differential equation discretized in space and implicitly marched forward in time. The algorithms are extensions of Jacobi and SOR. The extensions consist of iterating over a window of several timesteps, allowing efficient overlap of computation with communication. The methods increase the degree to which work can be performed while data are communicated between processors. The effect of the window size and of domain partitioning on the system performance is examined both by implementing the algorithm on a simulated multiprocessor system. E.A.K.

N86-11857# Air Command and Staff Coll., Maxwell AFB, Ala.
A COMPUTER ENGINEERING CURRICULUM FOR THE AIR FORCE ACADEMY: AN IMPLEMENTATION PLAN
L. L. Burge, Jr. Apr. 1985 113 p
(AD-A156464; ACSC-85-0335) Avail: NTIS HC A06/MF A01 CSCL 05/9

The recent advances in computer technology which impact present and future Air Force systems led the Air Force Academy to include computers and information systems engineering courses in the curriculum. This analysis addresses the issue of a major in computer engineering at the Academy. The Air Force computer engineer (AFSCs 2625, 2736 and 2885) specializes in designing, developing, installing, and testing embedded computer systems in aircraft, missiles, flight simulators, and command, control, and communications systems. An embedded computer system is all computer equipment, programs, data, documentation, personnel, and supplies integral to a defense system from the design, acquisition, or operations and support point of view. This report addresses the Air Force need for computer engineers, the need for the computer engineering major at the Academy, the appropriate department to administer the major, the structure of the degree, and the implementation of the discipline at the Academy.
Author (GRA)

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering.*

N86-11858# Los Alamos National Lab., N. Mex.
SIXTH BIENNIAL CUBE (COMPUTER USE BY ENGINEERS) SYMPOSIUM Abstracts Only
Aug. 1984 125 p Symp. held in Los Alamos, N. Mex., 10-12 Oct. 1984
(Contract W-7405-eng-36)
(LA-10240-C) Avail: NTIS HC A06/MF A01

A symposium was conducted to exchange information on computer hardware and software developments and applications

among engineers at the Los Alamos, Lawrence Livermore, and Sandia National Laboratories. The CUBE Symposium benefits the participants and their respective Laboratories by providing a forum for: (1) sharing information on recently developed and current computer codes for modeling physical processes; (2) discussing solutions to a broad range of engineering problems both in weapons and in energy programs; (3) illustrating the development and effectiveness of computer methods for design, control, and experiment interpretation; (4) describing creative approaches to the solution of engineering problems; and (5) exploring trends in hardware/software and their impact on engineering. For individual titles, see N86-11859 through N86-11887.

N86-11859# California Univ., Livermore. Lawrence Livermore Lab. Applications Systems Div.
SOFTWARE ENGINEERING TOOLS THAT WORK Abstract Only c61
David Balaban *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 7 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

An overview of a very new, highly integrated, set of software engineering tools is presented. This set of tools is powerful enough to be applied to any software system including real-time systems, data base systems, and communications systems. The tools are designed for all phases of software development from preliminary analysis through detailed design. The generality and utility of this methodology result from the fact that three different software models are used and integrated. One model describes data transformation; another model describes stored data; and a third model describes dynamics. These models provide a useful basis for classifying software systems and a complete elegant methodology for developing software. G.L.C.

N86-11860# California Univ., Livermore. Lawrence Livermore Lab. Applications Systems Div.
AN APPLICATION OF REAL-TIME ANALYSIS AND DESIGN TOOLS IN SOFTWARE DEVELOPMENT Abstract Only c61
Don W. Freeman *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 7 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

A software system was written to perform real-time data acquisition and analysis on a newly designed dynamic mechanical spectrometer at Sandia National Laboratory, Livermore. This research software was developed using several modern real-time analysis and design tools. These tools were not used to their maximum capability, since this would have increased the software development time significantly and unnecessarily. However, the appropriate use of these tools has made this software particularly easy to understand, construct, debug, and ungrade. The overall system architecture was first specified using data flow diagrams. These were reviewed and approved by the end user. Structure charts for the major software subsystems were then constructed. The code was easily generated from the structure charts. At the same time that this top-down analysis and design was being carried out, some software was being developed from the bottom up to deal with the instrumentation in a conceptual way. These instrumentation routines were developed to hid the nitty-gritty bit level details from the user so that he/she can interact with the instrumentation in human terms. Author

N86-11861# Los Alamos National Lab., N. Mex. Engineering Analysis Section.
DESIGN OPTIMIZATION OF THE POWER GENERATION SYSTEM FOR A SPACE-BASED FREE-ELECTRON LASER Abstract Only c36
Norman M. Schnurr *In its* 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 10 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

A computer program, FELWT, was developed to perform a system optimization of the power generation system for a space-based free-electron laser. A detailed cooling analysis of the linear accelerator and computations of cooling requirements for the klystrons, electron dumps, and injectors are performed. A prime power-generation system consisting of a combustor, a turbine, and a generator is analyzed and hydrogen and oxygen requirements are determined. Performances of various components depend on operating temperatures so that analyses of individual components are coupled in a rather complex fashion. Several levels of iteration are used in the code to obtain a simultaneous solution of the entire system of governing equations. A parametric study is performed to determine optimum operating conditions. Author

N86-11862# Sandia Labs., Albuquerque, N. Mex. Thermophysical Properties Div.
OPTICAL MODELING OF MULTILAYER THIN/THICK FILMS Abstract Only c76
Richard B. Pettit *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 10-11 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

A computer program was written to implement a calculation of the optical reflectance and transmittance characteristics of an arbitrary multilayer film k that can include both thick and thin films. For the thin films (film thickness comparable to the wavelength), complex Fresnel reflection and transmission coefficients are calculated in order to preserve phase information (interference effects) between the films. Recursion relations are then used to replace each multilayer thin film stack with effective Fresnel coefficients. For films thick compared to the wavelength, reflectance and transmittance intensity coefficients are used, together with a multiple reflection recursion relation, to calculate the overall reflectance and transmittance of the stack. This amounts to effectively averaging over phases in the thick films. Thus the optical characteristics of multiple thin films on both sides of a thick glass substrate, for example, can be accurately calculated. In the program, these properties can be calculated as a function of incident angle, polarization and wavelength. Application of this program to several practical situations will be illustrated. Author

N86-11863# California Univ., Livermore. Lawrence Livermore Lab. Nuclear Energy Systems Div.
NET-2 MODELS OF CAVITIES AND DIODES Abstract Only c33
George E. Vogtlin *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 11 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

The network analysis program, Net-2, was used to model microwave cavities and wave guides. Techniques using both lumped lines and distributed transmission lines were used with good agreement compared to measured values. This technique is applicable to pill box and rectangular cavities as well as rectangular and circular wave guides. Higher order modes can be modeled in addition to the fundamental mode. Pulse driven diodes were modeled using Child-Langmuir limited current. These models use six to nine sections to represent the various radial currents and ection parameters. Complex rise-times and resonances were evaluated and measured to several giga hertz. Author

N86-11864# Sandia Labs., Albuquerque, N. Mex. Theoretical Div.
CALCULATION OF THE ELECTRON BACKSCATTERING COEFFICIENT BY MONTE CARLO SIMULATION Abstract Only c76
Arlyn J. Antolak and William Williamson, Jr. (Toledo Univ.) *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 11 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

The Monte Carlo electron/photon transport code SANDYL is used to compute the total electron backscattering yield eta in the energy range 20 to 100 keV. The backscattering from bulk solids, thin self-supporting films, and from thin films on substrates is computed for various targets at normal and oblique incidence of the primary electron beam. The results of the theoretical model

are compared with experimental scanning electron microscope data. Author

N86-11865# California Univ., Livermore. Lawrence Livermore Lab. Engineering Research Div.
PARTICLE PUSHING TECHNIQUES FOR USE WITH FINITE ELEMENT BASED FIELD CALCULATIONS Abstract Only c64
John C. Peterson *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 12 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

The discrete particle-mesh method is widely used for finding self-consistent solutions to Maxwell's equations. In this approach to modeling the behavior of plasmas, one alternates between: (1) solving for the electromagnetic fields that arise from the current and charge distributions (determined by the position and velocity of all the discrete particles in the system), and (2) updating the position and velocity of all the discrete particles using the usual laws of mechanics and the forces which result from the fields calculated above. In many engineering situations, the presence of curved boundaries makes it advantageous to use finite element methods to do the field computations. The irregular aspect of the grids used with finite element methods complicates the process of locating a particle in the mesh, so that the fields acting on that particle can be determined. A method for keeping track of the particle locations was developed and implemented in the Galerkin ElectroMagnetics code, or GEM2D. The method will be described, and selected results will be presented. Author

N86-11866# California Univ., Livermore. Lawrence Livermore Lab. Nuclear Test Engineering Div.
ICARUS: A COMPUTER CODE FOR MODELING COMPLEX ONE-DIMENSIONAL HEAT CONDUCTION ON MAINFRAMES AND MICROS Abstract Only c34
Steven B. Sutton *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 16 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

The geometry in numerous heat transfer problems can be approximated quite accurately as being one-dimensional. Under this condition, it is advantageous to use a one-dimensional computer code. The computer code ICARUS was developed to allow easy, straight forward modeling of complex one-dimensional systems. Two versions of the code exist: a large, full feature version for main-frame computers, and a smaller version written for use of micro computers. The large full feature version, written in FORTRAN, can account for material phase change (solidification or melting), multiple material regions, material gaps (across which radiation and convection can take place), temperature dependent material properties and time or temperature dependent general boundary conditions (specified temperature, applied heat flux, convection and/or thermal radiation). The phase change algorithm tracks the moving phase change front in a continuous fashion. The equations are formulated so that the solution can be fully implicit, fully explicit or Crank-Nicolsen. Output information is available in both hard-copy edits and graphics. The micro-computer version, written in IBM BASIC, can account for multiple material regions, general boundary conditions, and material gaps. In its present form, all properties and parameters must be constant in both time and temperature. The equations are formulated so that the solution can be fully implicit or fully explicit. A user friendly drive controls interactive specification of all input. Output information is presently available only in the form of printer edits. Author

N86-11867# Sandia Labs., Albuquerque, N. Mex.
THREE-DIMENSIONAL HEAT TRANSFER ANALYSIS USING THE PATRAN-G SOLIDS MODELING AND Q-TRAN THERMAL ANALYSIS COMPUTER CODES Abstract Only c34
James M. Nelsen, Jaime L. Moya, and H. Richard Yoshimura *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 17 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

A computer program to translate PDA PATRAN-G finite element meshes to finite difference meshes for use in the Q-TRAN thermal analysis computer code was developed. PATRAN-G, a solids modeling program, was extensively used to generate finite element models for structural analyses codes. However, this code was not previously used for two- or three-dimensional heat conduction models. This translator allows pre- and post-processing for thermal analysis of arbitrary two- and three-dimensional geometries. Furthermore, Q-TRAN offers analysis capabilities not furnished by other thermal analysis codes including phase change, spectral radiation, and improved solution algorithms. Examples will be provided demonstrating the pre- and post-processing capabilities of the PATRAN-G program used in the thermal analysis of the Beneficial Uses Shipping System (BUSS) cask. Author

N86-11868# Sandia Labs., Albuquerque, N. Mex. Structural Mechanics Div.
INTERFACE ELEMENTS FOR HEAT TRANSFER ANALYSIS Abstract Only c34
William E. Mason *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 17 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

Interface elements are desirable in finite element heat transfer analyses in situations where dissimilar meshes are to be joined or where contact resistances occur between various parts of a body. In stress codes, such elements are often termed master/slave. A general algorithm for interface elements will be described. The algorithm allows development of interface elements for both two- and three-dimensional applications. Surfaces in contact are automatically determined so that a minimum of input data is required. In addition, the algorithm allows for compatibility in thermal stress calculations with mechanical codes which have sliding interface capabilities. Implementation of the algorithm into the TACO codes will be discussed and examples will be given. Author

N86-11869# California Univ., Livermore. Lawrence Livermore Lab. Nuclear Test Engineering Div.
ANALYSIS OF ULTRASONIC WAVES IN A BOUNDED MEDIUM Abstract Only c71
Thomas A. Nelson and Gerald L. Goudreau *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 21 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

In their effort to design an acoustic shutter for the Nova Program, the Laser Program wished to study the propagation of ultrasonic (approx. 10 MHz) waves induced in the plane of the glass by a strip piezoelectric crystal mounted on an edge of the glass. The object is to set up a clean standing wave which forms a diffraction grating in the glass window with respect to laser light entering normal to the window. Early design analysis treated the axial vibration problem with a separate optical analogy governed by a scalar wave equation. Further, assuming lateral boundaries did not interfere with the longitudinal wave, ray techniques could solve the geometric optics problem. The item of interest was finding the optimum width of the piezoelectric crystal which launches the acoustic wave. Subsequent studies showed that lateral boundary effects were important to the wave characteristics and that attempting to launch a square wave front would generate a complicated stress state. The code DYNA2D was used to study transient stress wave propagation in a solid. This required an extremely fine mesh to capture the very short wave lengths of the ultrasonic wave. More relevant was the ultra high frequency steady state and modal solution. For the solid assumption (vector valued wave equation) codes NIKE2D and GEMINI were employed. For the scalar approximation of optics, the thermal code TACO2D was successfully adapted to solve the required steady state spatial operator. Author

N86-11870# California Univ., Livermore. Lawrence Livermore Lab. Engineering Research Div.
AN EVALUATION OF THREE GRAPHICS PACKAGES: THE METHODOLOGY AND RESULTS Abstract Only c61
Brian K. Cabral *In* LANL 6th Bien. CUBE (Computer Use by

Engineers) Symp. Aug. 1984 p 24 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

The increased use of computers in engineering environments coupled with the decreasing price of graphics equipment has resulted in the widespread use of graphics software. Much of the available graphics software is dependent on some application, machine, or graphics device. However there are a number of public domain graphics packages which attempt to be independent of these factors. A method of evaluating graphics packages as applied to three public domain graphics packages is introduced. The methodology presented is designed in a top-down fashion. It begins by exploring the high level functionality dealing with application interface issues, such as ease of use and completeness of functionality. Software design issues, documentation, and error handling are discussed in conjunction with the other high level functionalities. The methodology continues by investigating the low level functionality which includes performance measurements and the ability to add new devices to the package. The methodology was used in an evaluation of three public domain graphics packages. The evaluation took place on a VAX running VMS which supported a large number of graphics devices. By creating an environment conductive to unbiased observations, the evaluators were able to investigate all three packages concurrently. Author

N86-11871# Los Alamos National Lab., N. Mex. Analysis and Testing Group.
INTERACTIVE GRAPHICS FOR FINITE ELEMENT PREPROCESSING Abstract Only **c61**
W. Rob Oakes, Jr. *In its* 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 24 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

Graphics interactivity for finite element preprocessing was increased by using newly available terminal hardware and graphics software. Interactivity between users and codes was increased by reducing input-output to graphics terminals and by increasing the information content of images. Advanced terminal design that allows higher level graphics entities is primarily responsible for more effective terminal-application communications. Hardware-zoom-and-pan, retained segments, markers, and panels are discussed, showing how each has allowed the number of images sent, the volume of data for each image, and user input volume to be reduced by increasing graphical input. The augmented CGS language used to implement the software and why this was chosen over one likely alternative will be explained. Increased information content of graphics images has improved interactivity. The uses of color, and the JONES-D hidden surface algorithm and why it is well suited by to finite element preprocessing are discussed.
Author

N86-11872# Los Alamos National Lab., N. Mex. Advanced Engineering Technology Group.
GEOLOGICAL CALCULATIONS WITH SANGRE AND MANTLE: RECENT RESULTS Abstract Only **c46**
Lucy M. Carruthers, Peggy Goldman, and Charles A. Anderson *In its* 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 26 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

Q-13 has two finite-element calculational efforts involving geological studies, both two dimensional and both with extensive graphics output. The SANGRE code was developed at Los Alamos as an extension of TSAAS. Recent code developments include introduction of pore pressure, which has made possible some calculations with geologic folds that show the behavior of fluid during the geological fold process. The code has recently been linked to the STRAP code for graphical output--results will be shown. The MANTLE code work has continued in collaboration with Gerald Schubert of UCLA. Modeling efforts include slabs extending into the fluid region, with and without initial slab motion. Coupled calculations are made of temperature and creep. Graphics are internal to the code and show velocities, pressures, temperatures, stream functions, etc. Author

N86-11873# Sandia Labs., Albuquerque, N. Mex. Analytical Solid Mechanics Div.
APPLICATION OF A MIXTURE THEORY TO THE BINARY ALLOY SOLIDIFICATION PROBLEM Abstract Only **c26**
Vincent C. Prantil *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 27 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

Motivated by a principal interest in the continuous casting of alloys, an application of a mixture theory has been proposed for examining problems involving solidification of a multicomponent system. The formulation can provide a basis for studying the solidification of a binary alloy in which the two phases may be present in arbitrary amounts. The system is defined in terms of the constituent phases and alloying elements in which the volume fraction is utilized to model, in a continuous fashion, the amount of each phase present at a point. Balance laws for mass, momentum, and energy for each phase are presented which include terms for representing interactions between the mixture components. The idea of a structured continuum is adopted and the discrete nature of separable phases is discussed in light of how the system description reflects the characteristics of the solid-liquid system. The present work proposes methods for modeling rate of growth of solid as a mass exchange, using drag, buoyancy, and interfacial pressure forces in the momentum exchange, and including the latent heat and dissipation in the energy exchange for binary alloy solidification. Author

N86-11874# Sandia Labs., Albuquerque, N. Mex.
MICROCOMPUTER CONTROL AND DATA MANAGEMENT TECHNIQUES FOR TRANSIENT DIGITAL RECORDING Abstract Only **c61**
David A. Benson and Gary D. Miller *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 39 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

Techniques developed for microcomputer control of waveform recorders are discussed. These techniques have been effective in collecting transient high temperature data for an application which requires frequent changes of test configuration. This system allows the user to specify the recording configuration through a data file together with suitable annotations which give a full description of the experiments performed. Communications with the digital recorders are through the IEEE-488 bus to a Z80 computer driven by compiled BASIC software. Once the test data are captured by the recorders, the system retrieves and stores the data in a form previously specified. Data files from the waveform recorders are output using a compression technique which limits the number of points to those containing significant information. These data files also contain plot legends and fields of comments specific to each test. These are placed in a compact ASC2 format and stored on floppy disk media. Ability exists to control this post processing from simple commands embedded in a data file without further operator intervention. B.W.

N86-11875# California Univ., Livermore. Lawrence Livermore Lab. Nuclear Energy Systems Div.
A DATA TRANSLATOR FOR ENGINEERING MEASUREMENTS Abstract Only **c61**
Mel Wieting and Robert M. Trusty *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 40 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

The Engineering Measurements Section provides a complete measurement of service for all Lawrence Livermore National Laboratory (LLNL) programs. Because of the various types of data collected, several different acquisition systems are required, each having a different digital data format/medium. This has caused compatibility problems in analyzing and supplying the data to the end-users. The Data Translator was designed to solve these problems. The Data Translator uses either the IEEE-488 bus (GPIB) or an RS-232 serial line to receive data from the various data acquisition systems after the measurement is performed. The

488 bus provides a fast parallel transfer, but must be done locally. RS-232 transfers are much slower, but can be accomplished remotely using a modem. The Data Translator is based on an LSI-11/23 with 256k bytes of RAM and the RT-11 single job operating system. Data from the Data Translator are written to a disk file in a format compatible with SIG, an LLNL signal analysis program. Data analysis and graphics output can be accomplished using either SIG or a streamlined SIG look-alike program, on the Data Translator. B.W.

N86-11876# California Univ., Livermore. Lawrence Livermore Lab. Engineering Research Div.
SIG: A GENERAL-PURPOSE SIGNAL PROCESSING CODE Abstract Only c61
Darrel L. Lager and Stephen G. Azevedo *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 40-41 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

SIG is a general-purpose signal processing, analysis, and display program for performing manipulations on time- and frequency-domain signals. It has been designed to ultimately accommodate other representations for data such as multiplexed signals and complex matrices. Many of the basic operations one would perform on digitized data are contained in the core SIG package. These range from basic arithmetic (add, subtract, multiply, divide), to resampling, filtering and graphically displaying results. More sophisticated operations include several methods of estimating transfer functions, performing spectral estimation and doing parameter estimation. Out of these core commands, more powerful signal processing algorithms may be built. SIG provides two user interfaces: a menu mode for the occasional user, and a command mode for the sophisticated daily user. In both modes, errors are detected as early as possible in the processing and are indicated by friendly, meaningful messages. Options exist for multiple commands per line, commenting lines, defining commands, executing command files with arguments and the writing of custom menus. Author

N86-11877# California Univ., Livermore. Lawrence Livermore Lab. Nuclear Test Engineering Div.
THERMO-MECHANICAL ANALYSES OF LASER-HEATED SURFACES Abstract Only c36
Gary L. Johnson *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 44 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

The Lawrence Livermore National Laboratory (LLNL) needs to heat metal parts to melt temperatures using a highly focused laser. In addition to the mechanical loads applied to the part, thermally induced stresses occur near the heated area. The objective of this work was to specify the surface heat load and cooldown rate parameters which would provide the desired melt zone geometry while assuring an acceptable level and distribution of thermally-induced plastic strain and stress. To model the thermo-mechanical response of the part to various heat loads, the thermo-elastic-plastic model in the finite element structural code, NIKE2D was used based on the temperature response calculated by the thermal code, TACO2D. Author

N86-11878# Sandia Labs., Albuquerque, N. Mex. Computational Physics and Mechanics Div.
FINITE DIFFERENCE CALCULATIONS OF VOLTAGES GENERATED IN THIN DIELECTRIC LAYERS SUBJECTED TO SHOCK LOADING Abstract Only c76
Jeffrey W. Swegle *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 44-45 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

Difficulties which recently developed in weapon systems tests were thought to be due to high voltages being generated in thin layers of dielectric materials in the outer shell of the device when the HE was detonated. Due to the difficulties involved in measuring these voltages, a theoretical investigation was undertaken of the mechanisms of voltage generation in these thin dielectric layers when subjected to shock loading. The situation was studied using the automatically rezoning Lagrangian finite-difference wavecode ART00 to explicitly predict the charge generated in each layer. The device was modeled including the thin layers in the outer shell, and the code was modified to predict the charge generated in each layer as well as the capacitance of each layer as the dimensions changed. The polarization of the dielectric in each layer was calculated based on the assumption that the induced polarization was a function only of the maximum pressure and did not revert during the time of interest of the calculation. The charge generated in each layer was then calculated as the layer area times the induced polarization. These calculations provided the only readily available means of assessing the cause of the problems. Author

N86-11879# Sandia Labs., Albuquerque, N. Mex.
A TIME-SPLITTING NUMERICAL TECHNIQUE FOR SOLVING HIGHLY COUPLED TWO-PHASE FLOW CONSERVATION EQUATION Abstract Only c34
R. J. Gross and M. R. Baer *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 48-49 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

A time-splitting numerical technique incorporating the positive aspects of flux-corrected transport (FCT) and the method of lines (MOL) has been developed to efficiently and accurately solve systems of highly coupled hyperbolic partial differential equations. Several two-phase flow equation systems, including that of modeling deflagration-to-detonation transition (DDT) in granular explosives, are used to illustrate the method. Upwind differencing, MOL, and FCT are also used to solve the model problems so that one can compare the new technique to established methods. The results show that time-splitting offers increased accuracy for these types of problems, although in one dimension the method is computationally more costly. However, in multidimensional calculations, the time-splitting technique should offer an economy of computer cost and storage. Author

N86-11880# California Univ., Livermore. Lawrence Livermore Lab. Field Test Systems Div.
PHOTOELECTRON TRAJECTORY ANALYSES OF STREAK TUBES Abstract Only c35
Ching C. Lai *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 53 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

A streak tube is a precision high voltage vacuum photonic device capable of registering the temporal variation of multiple signal channels with subnanosecond resolution. The streak tube has become the vital component of the current time-resolved prompt diagnostics instrumentation system for the Nuclear Test Program. The performance of the streak tube is predominately governed by the trajectory behavior of all the photoelectrons traveling from the photocathode through the deflection region to the phosphor anode. The trajectory analyses require a finite-element-method based on computer program to solve Poisson's equation for potential distribution and to calculate the trajectories. Two codes (GUNSLAC and EBQ) in the CDC-7600 computer were used for the designing of a prototype large-format streak tube, and the evaluation of two existing tubes, RCA-C73435 and ITT-2XIC16. Analyses were performed by varying the electrode's configuration, voltage, photoelectron's energy, emitting orientation and current. Both the computer generated trajectory plots and the numerical data summaries are presented. Author

N86-11881# California Univ., Livermore. Lawrence Livermore Lab. Nuclear Energy Systems Div.
RAMP RESPONSE ESTIMATION AND SPECTRUM EXTRAPOLATION FOR ULTRASONIC SCATTERING Abstract Only c71
Gregory A. Clark *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 55 (For primary document see N86-11858 02-60)

Avail: NTIS HC A06/MF A01

A combined application of digital signal processing, estimation theory, and scattering theory is used to attack the important problem of target identification. The basic problem is that of examining an object with an ultrasonic pulse and using the reflected signal to determine various properties of the object. Typically, an impulse reponse h(t) can be calculated from knowledge of the (input x(t)) signal and the reflected (output y(t)) signal. If the impulse response can be found, it can sometimes contain important information about the object. We have studied some new algorithms for impulse response estimation. It is also well-known that the ramp response contains information about the cross-sectional area of the scatterer. The ramp response can be calculated directly from the impulse response, but the estimate of cross-sectional area is degraded by the fact that the ultrasonic transducer severely bandlimits the data. Algorithms have been produced for extrapolating the ramp response spectrum to improve the cross-sectional area estimates from the ramp response technique. Experimental results demonstrating the estimation of properties of a known flaw (created by a saw cut) in a block of aluminum are presented. Author

N86-11882# Sandia Labs., Albuquerque, N. Mex. Thermofluids Div.

SIMULATION OF FLAME PROPAGATION THROUGH VORTICITY REGIONS USING THE DISCRETE VORTEX METHOD Abstract Only **c34**

Pamela K. Barr *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 59 (For primary document see N86-11858 02-60)

Avail: NTIS HC A06/MF A01

Interaction of a freely propagating premixed flame with regions of high vorticity in the flow is investigated using a computer model. These vorticity regions are formed due to the flame-generated volume expansion that pushes gas past obstacles ahead of the flame. In the computer model the discrete vortex dynamics method is used to simulate the time developent of the vorticity regions downstream of each obstacle. The flame front is modeled as a wrinkle laminar flame interface that propagates normal to itself at the laminar burning velocity, separating the two different density fluids: burned and unburned. Two different obstacle configurations are discussed. In the first case, a flame causes unburned gas to exhaust out of a planar duct, and when the flame reaches the duct exit it interacts with the vorticity which was formed at the exit. The second case involves a series of obstacles in a channel. Here, the repeated obstacles in the channel lead to acceleration of the flame, as indicated by the dramatic increase in the rate of fuel consumption. Author

N86-11883# Sandia Labs., Albuquerque, N. Mex.

APPLICATION OF FLUX-CORRECTED TRANSPORT (FCT) TO HEAT TRANSFER/FLUID MECHANICS PROBLEMS Abstract Only **c34**

R. J. Gross, M. R. Baer, and C. E. Hickox *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 60 (For primary document see N86-11858 02-60)

Avail: NTIS HC A06/MF A01

The FCT finite-difference technique was developed to minimize numerical diffusion in concert with avoiding numerical dispersion (no artificial maxima or minima). As a result, the method is well-suited for accurately solving convective-diffusive flow equations. One-dimensional and two-dimensional solvers have been developed which utilize and explicit FCT approach. The solvers are vectorized for optimum execution on the CRAY. For instance, on a 50x50 grid, the two-dimensional solver may take up to 0.06 sec, per transport equation, per timestep, on the CRAY. In addition, the solvers are essentially canned to facilitate use by others. The flexibility of the FCT technique will be illustrated by showing results obtained for a variety of fluid flow/heat and mass transfer problems. Two-dimensional results will be presented for a Riemann shock problem, the classical Kelvin-Helmholtz and Rayleigh-Taylor flow instability problems, natural convective flow in a porous medium, thermal-solutal flow in a porous medium, and solution of the acoustic-filtered conservation equations describing a fire within a room. Author

N86-11884# Sandia Labs., Albuquerque, N. Mex. Analytical Thermal/Fluid Mechanics Div.

HEAT TRANSFER AND PRESSURE CHANGES DUE TO A LARGE TEMPERATURE DIFFERENCE ACROSS AN ENCLOSED VERTICAL AIR LAYER Abstract Only **c34**

D. R. Chenoweth and S. Paolucci *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 61-62 (For primary document see N86-11858 02-60)

Avail: NTIS HC A06/MF A01

The TRACE-2D Code has been used to obtain non-Boussinesq results from transient, compressible and two-dimensional calculations using Sutherland law conductivity and viscosity property variations for air. These free convection results are limited to the laminar flow region. The aspect ratio A of the vertical air layer, with adiabatic top and bottom walls, is taken to be unity or greater, and the Rayleigh number Ra based on the layer width is as large as 10 to the 7th power when A = 1. The results are valid for large temperature differences between the hot and cold isothermal walls, epsilon = sub T(h) - sub T(c) < or = 0.6, where the limitation is due to the Sutherland law accuracy. The various flow regimes are defined in terms of epsilon, A and Ra and correlations are developed for the Nusselt number and pressure in terms of these parameters. It is shown that, with proper non-dimensionalization, much of the vast body of literature concerning Nusselt number correlations and vertical temperature stratification for the Boussinesq case (which is asymptotically approached here for epsilon < < 1) can be used where epsilon is not small. Author

N86-11885# California Univ., Livermore. Lawrence Livermore Lab. Engineering Research Div.

FLEXIBLE VIBRATIONS OF A UNIFORM ELASTIC BEAM WITH ARBITRARY SUPPORTS AND LUMPED MASSES Abstract Only **c39**

Donald T. Gavel and Howard Woo *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 73 (For primary document see N86-11858 02-60)

Avail: NTIS HC A06/MF A01

This presentation introduces a simplified and systematic method for estimating the flexible vibrations of an elastic beam of uniform thickness with arbitrary supports and lumped masses. The method used is an eigenfunction expansion approach based on the free-free beam solution. A general form of the vibration model (called FLXBEAM) has been implemented within the DELIGHT computer-aided engineering package on a VAX/11-70. Results from example runs were favorably compared against finite-element solutions. After the user specifies a beam model into the interactive DELIGHT/FLXBEAM package, the computer can calculate frequencies, pilot mode shapes, and simulate the dynamic response of the beam all within a few minutes. This interactive package provides designers with a handy tool for quickly analyzing flexible beams under dynamic loads. Author

N86-11886# Sandia Labs., Albuquerque, N. Mex. Thermofluids Div.

A HYBRID VORTEX-IN-CELL FINITE-DIFFERENCE NUMERICAL METHOD FOR TURBULENT SHEAR LAYER COMPUTATION Abstract Only **c34**

Nagi N. Mansour *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 95-96 (For primary document see N86-11858 02-60)

Avail: NTIS HC A06/MF A01

A hybrid numerical scheme is presented to compute turbulent shear flows. The scheme divides the computational domain D into two regions, D sub 1 and D sub 2 and the vorticity equation is solved by different methods in each region. In region D sub 1, a Lagrangian formulation (vortex-in-cell) is used, while in region D sub 2 an Eulerian formulation (finite-difference) is used. At the boundary between the two regions, discrete Lagangian vorticity can be convected and converted into Eulerian grid vorticity.

Conversely, Eulerian fluxes of vorticity at this boundary are discretized so that in D vorticity is conserved and vorticity transport does not realize the imposition of the artificial boundary. This particular method has been developed to compute spatially-developing turbulent shear layers in two dimensions. Turbulent shear layers have a large range of length scales from the initial thin boundary layer near the splitter plate to large coherent vortex structures which continue to grow with downstream distance. Thus, by starting with discrete Lagrangian vorticity and changing to continuous Eulerian vorticity, the advantages of both methods can be used to simulate a larger flowfield domain than achievable with either method alone. B.W.

N86-11887# California Univ., Livermore. Lawrence Livermore Lab. Nuclear Explosives Engineering Div.
COMPUTER CODES FOR FLUID-STRUCTURE INTERACTIONS Abstract Only **c34**
W. H. McMaster *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 96 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

Three fluid dynamics codes, PELE-IC, PELE 3D and MAUI are available for the analysis of fluid-structure interactions where the fluid motion is drastic enough to cause difficulties in the Lagrangian formulation. The fluid-structure-interaction algorithms in these codes have been developed for the analysis of the dynamic response of coupled fluid-structure systems. The fluid motion is computed using an Eulerian differencing formulation and the structural motion is determined from a finite element code. The coupling is affected across the Lagrangian boundary defining the structure. These codes can be used over a wide range of fluid and structural motions. The incompressible fluid approach in the PELE codes is used when the effects of compressibility are minimal and the acoustic approximation suffices. The explicit algorithm of the MAUI code can handle those situations where compressible effects are important, and it can also accommodate shock waves. All three codes are in the public domain. Author

N86-11888# Stanford Univ., Calif. Computer Systems Lab.
DIRECTLY EXECUTED LANGUAGES Final Report, 19 Apr. 1982 - 30 Jun. 1985
M. J. Flynn 10 May 1985 13 p
(Contract DAAG29-82-K-0109)
(AD-A157311; ARO-18553.1-EL) Avail: NTIS HC A02/MF A01 CSCL 09/2

Computer architectures or instruction sets can be designed to be in close correspondence with high level computer languages. Techniques for designing this correspondence have been developed which produce instruction sets called Direct Correspondence Architectures, or DCAs. DCA representation minimize the number of bits needed to encode an instruction, as well as minimizing many of the dynamic parameters associated with program execution. In a Pascal-based DCA, the following reductions were achieved for a broad range of benchmarks when compared to a breadbasket of conventional architectures such as S/370, VAX, and P-code: (1) instruction bandwidth reduction: 3.46, (2) data read reduction (in bytes): 5.42, and (3) data write reduction (in bytes): 14.72. A microprocessor based implementation of a Pascal-based DCA has begun. Issues in concurrency detection for these and other architectures have been investigated. Author (GRA)

N86-11889# Michigan Univ., Ann Arbor. Coll. of Engineering.
IMPROVING THE COMPREHENSIBILITY OF A SIMULATED TECHNICAL MANUAL
D. E. Kieras 20 Jun. 1985 57 p
(Contract N00014-84-K-0729)
(AD-A157482; TR-85/ONR-20) Avail: NTIS HC A04/MF A01 CSCL 05/10

It is clear that careful rewriting can improve the comprehensibility and usability of a technical document. But exactly how the document should be modified to accomplish this improvement has been unclear. In two experiments, a simulated technical manual for a simple piece of equipment was evaluated for comprehensibility using well-defined rules, and rewritten to eliminate the specific comprehension problems detected by the rules. Unlike conventional readability formulas or writer's guidelines, these rules were based on results and theory from research on comprehension processes, and thus concern what aspects of text are actually difficult for the reader to process. Substantial improvements in performance were observed in tasks in which the subject had to learn how to operate the equipment using the manual. These results suggest that a computer-based system that could apply the comprehensibility rules would be useful in improving the quality of technical documents. Author (GRA)

N86-11890# Federal Compiler Testing Center, Falls Church, Va. Office of Software Development and Information Technology.
Ada (TRADEMARK) COMPILER VALIDATION SUMMARY REPORT: DATA GENERAL CORPORATION, ADE Ada COMPILER, VERSION 2.30.03.12, ECLIPSE DS/4000, DS/4200, MV/4000-DC, MV/8000-C, MV/8000-2, MV/10000, MV/10000 SX USING AOS/VS 5.04 AND AOS/RT32 4.001.00
May 1985 25 p
(AD-A157573) Avail: NTIS HC A02/MF A01 CSCL 09/2

The purpose of this Validation Summary Report is to present the results and conclusions of performing standardized tests on the Data General Corporation ADE Ada Compiler. On-site testing was performed between 29 April 1985 and 3 May 1985 at Data General Corporation headquarters, Westboro, Massachusetts, under the auspices of an Ada Validation Facility (AVF), the Federal Software Testing Center, according to current Ada Validation Office policies and procedures. The Data General ADE Ada Compiler is hosted on those systems listed in the table below. The hosts, as well as selected AOS/RT32 based systems served as the target systems. The suite of tests known as the Ada Compiler Validation Capability (ACVC), Version 1.5, was used. The ACVC suite of tests is used to validate conformance of the compiler ANSI/MIL-STD-1815A (Ada). This standard is described in the ANSI Ada Reference Manual, January 1983. Not all tests in the ACVC test suite are applicable to this specific implementation. Also, known test errors in Version 1.5 are present in some tests; these tests were withdrawn. The purpose of the testing is to ensure that the compiler properly implements legal language constructs and that it identifies, rejects from processing, and labels illegal constructs. GRA

N86-11891# Softech, Inc., Fairborn, Ohio.
Ada (TRADEMARK) COMPILER VALIDATION SUMMARY REPORT: VERDIX Ada COMPILER, VERDIX Ada DEVELOPMENT SYSTEM (VADS) VAda-010-1010, VERSION V05.00, FOR SUN MICROSYSTEMS MODEL 2/120 USING UNIX (TRADEMARK) 4.2 BSD, RELEASE 1.1 Final Report
Jun. 1985 48 p
(Contract F33600-84-D-0280)
(AD-A157574) Avail: NTIS HC A03/MF A01 CSCL 09/2

The purpose of this Validation Summary Report is to present the results and conclusions of performing standardized tests on the Verdix Ada compiler. On-site testing was performed 28 to 30 April 1985 at Verdix Western Operations in Aloha, Oregon, under the auspices of the Ada Validation Facility, according to the Ada Validation Office policies and procedures. The Verdix Ada compiler (Verdix Ada Development System (VADS), VAda-010-1010) is hosted on the Sun Microsystems Model 2/120 computer operating under Berkeley UNIX 4.2 BSD, Release 1.1. The suite of tests known as the Ada Compiler Validation Capability (ACVC), Version 1.5, was used. The ACVC suite of tests is used to validate conformance of the compiler to ANSI/MIL-STD-1815A (Ada). This standard is described in the ANSI Ada Reference Manual, January 1983. Not all tests in the ACVC test suite are applicable to a specific implementation. Also, known test errors in Version 1.5 are present in some tests; the tests were withdrawn. The purpose of the testing is to ensure that the compiler properly implements legal language constructs and that it identifies, rejects from processing, and labels illegal language constructs. The testing also identifies implementation-dependent behavior permitted by the standard. GRA

N86-11892# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
DATA ANALYSIS USING A DATA BASE DRIVEN GRAPHIC ANIMATION SYSTEM
D. H. Schwieder, H. D. Stewart, and J. N. Curtis 1985 10 p refs
(Contract DE-AC07-76ID-01570)
(DE85-014635; EGG-M-14285) Avail: NTIS HC A02/MF A01

A graphics animation system was developed to assist engineers in the analysis of large amounts of time series data. Most prior attempts at computer animation of data involve the development of large and expensive problem-specific systems. A generalized interactive computer animation system designed to be used in a wide variety of data analysis applications is discussed. By using relational data storage of graphics and control information, considerable flexibility in design and development of animated displays is achieved. DOE

N86-11995# Joint Publications Research Service, Arlington, Va.
HIGH-SPEED SIGNAL PROCESSOR DEVELOPED Abstract Only
In its China Rept.: Sci. and Technol. (JPRS-CST-85-015) 16 May 1985 p 10 Transl. into ENGLISH from Jisuanji Shijie (Beijing), no. 7, 8 Apr. 1984 p 7 (For primary document see N86-11994 02-70)
Avail: NTIS HC A07/MF A01

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N86-11893*# Illinois Univ., Urbana-Champaign. Software Systems Research Group.
THE EMBEDDED OPERATING SYSTEM PROJECT
Roy H. Campbell May 1985 338 p refs
(Grant NsG-1471)
(NASA-CR-176280; NAS 1.26:176280) Avail: NTIS HC A15/MF A01 CSCL 09B

The design and construction of embedded operating systems for real-time advanced aerospace applications was investigated. The applications require reliable operating system support that must accommodate computer networks. Problems that arise in the construction of such operating systems, reconfiguration, consistency and recovery in a distributed system, and the issues of real-time processing are reported. A thesis that provides theoretical foundations for the use of atomic actions to support fault tolerance and data consistency in real-time object-based system is included. The following items are addressed: (1) atomic actions and fault-tolerance issues; (2) operating system structure; (3) program development; (4) a reliable compiler for path Pascal; and (5) mediators, a mechanism for scheduling distributed system processes. E.A.K.

N86-11894*# California Univ., Santa Barbara.
ADS: A FORTRAN PROGRAM FOR AUTOMATED DESIGN SYNTHESIS: VERSION 1.10 Final Report
G. N. Vanderplaats Sep. 1985 46 p refs
(Grant NAG1-567)
(NASA-CR-177985; NAS 1.26:177985) Avail: NTIS HC A03/MF A01 CSCL 09B

A new general-purpose optimization program for engineering design is described. ADS (Automated Design Synthesis - Version 1.10) is a FORTRAN program for solution of nonlinear constrained optimization problems. The program is segmented into three levels: strategy, optimizer, and one-dimensional search. At each level, several options are available so that a total of over 100 possible combinations can be created. Examples of available strategies are sequential unconstrained minimization, the Augmented Lagrange Multiplier method, and Sequential Linear Programming. Available optimizers include variable metric methods and the Method of Feasible Directions as examples, and one-dimensional search options include polynomial interpolation and the Golden Section method as examples. Emphasis is placed on ease of use of the program. All information is transferred via a single parameter list. Default values are provided for all internal program parameters such as convergence criteria, and the user is given a simple means to over-ride these, if desired. Author

N86-11895*# Hawaii Univ., Honolulu. Dept. of Electrical Engineering.
A CASCADED CODING SCHEME FOR ERROR CONTROL
Tadao Kasami (Osaka Univ., Toyonaka, Japan) and Shu Lin 1 Oct. 1985 44 p refs
(Grant NAG5-407)
(NASA-CR-176276; NAS 1.26:176276) Avail: NTIS HC A03/MF A01 CSCL 09B

A cascaded coding scheme for error control was investigated. The scheme employs a combination of hard and soft decisions in decoding. Error performance is analyzed. If the inner and outer codes are chosen properly, extremely high reliability can be attained even for a high channel bit-error-rate. Some example schemes are studied which seem to be quite suitable for satellite down-link error control. E.A.K.

N86-11896*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
CELCAP: A COMPUTER MODEL FOR COGENERATION SYSTEM ANALYSIS
Jul. 1985 108 p refs
(Contract NAS7-918; N68305-84WR-40126)
(NASA-CR-176306; JPL-Pub-85-20; NAS 1.26:176306) Avail: NTIS HC A06/MF A01 CSCL 09B

A description of the CELCAP cogeneration analysis program is presented. A detailed description of the methodology used by the Naval Civil Engineering Laboratory in developing the CELCAP code and the procedures for analyzing cogeneration systems for a given user are given. The four engines modeled in CELCAP are: gas turbine with exhaust heat boiler, diesel engine with waste heat boiler, single automatic-extraction steam turbine, and back-pressure steam turbine. Both the design point and part-load performances are taken into account in the engine models. The load model describes how the hourly electric and steam demand of the user is represented by 24 hourly profiles. The economic model describes how the annual and life-cycle operating costs that include the costs of fuel, purchased electricity, and operation and maintenance of engines and boilers are calculated. The CELCAP code structure and principal functions of the code are described to how the various components of the code are related to each other. Three examples of the application of the CELCAP code are given to illustrate the versatility of the code. The examples shown represent cases of system selection, system modification, and system optimization. Author

N86-11897*# Illinois Univ., Urbana-Champaign. Dept. of Computer Science.
RESEARCH IN THE DESIGN OF HIGH-PERFORMANCE RE-CONFIGURABLE SYSTEMS Semiannual Status Report, 1 Apr. - 30 Sep. 1985
D. L. Slotnick 30 Sep. 1985 38 p
(Grant NAG5-377)
(NASA-CR-176275; NAS 1.26:176275; SASR-4) Avail: NTIS HC A03/MF A01 CSCL 09B

The initial control and programming philosophies of the RELAPSE are discussed. A block diagram showing the relationship of the Arithmetic Units (composed of Stages and Bit Processors), to the Functional Units, and other components of the RELAPSE is used to guide this discussion. The latest version of the Bit Processor design is presented. Included is a detailed discussion of the Bit Processor's new scratch pad memory component. The section also clarifies the usage of the Bit Processor's processing registers, and Input/Output functions. The final design phase of the Arithmetic Unit is underway by a study of the Proposed IEEE Floating Point Standard. The decisions on conformation to this

standard will be used as inputs into the finalization of the designs of the Bit Processor, Stage, and Arithmetic Units of the RELAPSE. G.L.C.

N86-11898# Lockheed-California Co., Burbank.
KRASH85 USER'S GUIDE: INPUT/OUTPUT FORMAT Final Report, Jan. - Sep. 1984
M. A. Gamon, G. Wittlin, and W. L. LaBarge Jul. 1985 240 p refs
(Contract DTFA03-84-C-00004)
(FAA-CT-85-10; LR-30777) Avail: NTIS HC A11/MF A01

The input and output formats appropriate for the computer program KRASH 85 are presented. Features that are incorporated into KRASH85 include: (1) an improved plastic hinge moment algorithm; (2) gear-oleo metering pin coding; (3) load-interaction curves; (4) an expanded initial conditions subroutine (combined with NASTRAN); (5) a comprehensive energy balance; (6) center of gravity (c.g.) displacement, velocity, acceleration and force time histories; (7) revised vertical beam orientation coding; (8) provision to save data for post-process i.e., acceleration, mass location and forces; (9) provisions to input preprocessed data; (10) a corrected uncoupled KR curve unloading/reloading algorithm; (11) provisions to define a tire spring (remains normal to the ground plane); (12) provisions to number the masses to an arbitrary sequence; and (13) an option to compute section shear and moment distributions. Author

N86-11899# Naval Postgraduate School, Monterey, Calif.
MODIFICATION OF HUFFMAN CODING M.S. Thesis
S. Kilic Mar. 1985 92 p
(AD-A156479) Avail: NTIS HC A05/MF A01 CSCL 17/2

Huffman coding minimizes the average number of coding digits per message. Minimizing the mean time by this method raises the problem of large variance. When the variance is large there is a greater probability that an arbitrary encoded message significantly exceeds the average. The delicate point here is the danger of an urgent message taking more time than expected, in addition to larger bandwidth or buffer requirements. With this research a large reduction of variance versus a small increase in mean time is examined for the purpose of modifying Huffman coding for a particular alphabet. Author (GRA)

N86-11900# Naval Research Lab., Washington, D. C.
MICROLAN, FILE TRANSFER PROGRAM FOR MICROPROCESSORS M.S. Thesis
R. D. Jaskot and H. W. Henry Mar. 1985 156 p
(AD-A156519) Avail: NTIS HC A08/MF A01 CSCL 09/2

The age of automation has established its foothold in today's society. Computerization now affects almost everyone's job, and sharing of information is vital to successful job performance. Manual transfer of information is inefficient and prone to error, so another means is needed. One option is computer networking. Both Local Area Networks and long-haul networks presently exist, but they are either very expensive or hardware dependent. It would normally require a long lead time and high costs for the military to acquire an information transfer system. To provide a readily available, low-cost file transfer system, the authors developed an assembly language program named MICROLAN, which is written to work with three of the main microcomputer operating systems (CP.M-80, CP/M-86, and MS.DOS) and to take advantage of RS232 technology. MICROLAN was successfully tested for file transfer at up to 4800 baud, and suggestions have been included as to possible uses for MICROLAN in the military environment. Additionally, possible methods for upgrading MICROLAN are also included. Author (GRA)

N86-11901# California Univ., Berkeley. Operations Research Center.
BAYESIAN EXTENSIONS TO A BASIC MODEL OF SOFTWARE RELIABILITY
W. S. Jewell Jun. 1985 25 p
(Grant AF-AFOSR-0122-81)
(AD-A157296; ORC-85-4) Avail: NTIS HC A02/MF A01 CSCL 09/2

A Bayesian analysis of the software reliability model of Jelinski and Moranda is given, based upon Meinhold and Singpurwalla. Important extensions are provided to the stopping rule and prior distribution of the number of defects, as well as permitting uncertainity in the failure rate. It is easy to calculate the predictive distribution of unfound errors at the end of software testing, and to see the relative effects of uncertainty in the number of errors and in the detection efficiency. The behavior of the predictive mode and mean over time are examined as possible point estimators, but are clearly inferior to calculating the full predictive distribution. Author (GRA)

N86-11902# Naval Postgraduate School, Monterey, Calif.
APPROXIMATE REASONING AND THE REVEAL SOFTWARE SYSTEM. USERS GUIDE M.S. Thesis
D. W. Verhagen Mar. 1985 141 p
(AD-A157298) Avail: NTIS HC A07/MF A01 CSCL 09/2

This thesis introduces the reader to some of the principles of fuzzy set theory and approximate reasoning. Sample applications are discussed with possible military situations outlined. The REVEAL software package is reviewed and its relationship with fuzzy set theory and approximate reasoning discussed. This thesis is designed to be used as a tutorial for REVEAL. Author (GRA)

N86-11903# Yale Univ., New Haven, Conn. Dept. of Computer Science.
EASY IMPOSSIBILITY PROOFS FOR DISTRIBUTED CONCENSUS PROBLEMS
M. J. Fischer, N. A. Lynch, and M. Merritt Jul. 1985 26 p Prepared in cooperation with Massachusetts Inst. of Tech., Cambridge
(Contract N00014-82-K-0154; N00014-85-K-0168; N00014-83-K-0125; DAAG29-84-K-0058; Grant NSF DCR-84-05478)
(AD-A157411; Yaleu/DCS/TR-405) Avail: NTIS HC A03/MF A01 CSCL 09/2

Easy proofs are given, of the impossibility of solving several consensus problems (Byzantine agreement, weak agreement, Byzantine firing squad, approximate agreement and clock synchronization) in certain communication graphs. It is shown that, in the presence of m faults, no solution to these problems exists for communication graphs with fewer than $3m+1$ nodes or less than $2m+1$ connectivity. While some of these results had previously been proved, the new proofs are much simpler, provide considerably more insight, apply to more general needs of computation, and (particularly in the case of clock synchronization) significantly strengthen the results. GRA

N86-11904# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
PROBABILISTIC ANALYSIS OF A NETWORK RESOURCE ALLOCATION ALGORITHM Interim Research Report, Apr. 1985
N. A. Lynch, N. Griffeth, M. J. Fischer, and L. J. Guibas Jun. 1985 44 p
(Contract N00014-83-K-0125)
(AD-A157553; MIT/LCS/TM-278) Avail: NTIS HC A03/MF A01 CSCL 09/2

A distributed algorithm is presented, for allocating a large number of identical resources (such as airline tickets) to requests which can arrive anywhere in a distributed network. Resources, once allocated, are never returned. The algorithm searches sequentially, exhausting certain neighborhoods of the request origin before proceeding to search at greater distances. Choice of search direction is made nondeterministically. Analysis of expected response time is simplified by assuming that the search direction is chosen probabilistically, that messages require constant time, that the network is a tree with all leaves at the same distance from the root, and that requests and resources occur only at leaves. It is shown that the response time is approximated by the number of messages of one that are sent during the execution of the algorithm, and that this number of message is a nondecreasing function of the interarrival time for requests. Therefore, the worst

case occurs when requests come in so far apart that they are processed sequentially. The expected time for the sequential case of the algorithm is analyzed by standard techniques. This time is shown to be bounded by a constant, independent of the size of the network. It follows that the expected response time for the algorithm is bounded in the same way. Author (GRA)

N86-11905# Ada Joint Program Office, Arlington, Va.
MILITARY STANDARD COMMON APSE (Ada PROGRAMMING SUPPORT ENVIRONMENT) INTERFACE SET (CAIS)
Jan. 1985 334 p
(AD-A157589) Avail: NTIS HC A15/MF A01 CSCL 09/2

This document provides specifications for a set of Ada packages, with their intended semantics, which together form the set of common interfaces for Ada Programming Support Environments (APSEs). This set of interfaces is known as the Common APSE Interface Set (CAIS). This interface set is designed to promote the source-level portability of Ada programs, particularly Ada software development tools. The CAIS applies to Ada Programming Support Environments which are to become the basic software life-cycle environments for Department of Defense (DOD) mission critical computer systems (MCCS). Those Ada programs that are used in support of software development are defined as tools. This includes the spectrum of support software from project management through code development, configuration management and life-cycle support. Tools are not restricted to only those software items normally associated with program generation, such as editors, compilers, debuggers, and linker-loaders. Groups of tools that are composed of a number of independent but interrelated programs (such as a debugger which is related to a specific compiler) are classed as tool sets. The goal of the CAIS is to promote interoperability and transportability of Ada software across DoD APSEs. GRA

N86-11859# California Univ., Livermore. Lawrence Livermore Lab. Applications Systems Div.
SOFTWARE ENGINEERING TOOLS THAT WORK Abstract Only
David Balaban *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 7 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

N86-11860# California Univ., Livermore. Lawrence Livermore Lab. Applications Systems Div.
AN APPLICATION OF REAL-TIME ANALYSIS AND DESIGN TOOLS IN SOFTWARE DEVELOPMENT Abstract Only
Don W. Freeman *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 7 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

N86-11870# California Univ., Livermore. Lawrence Livermore Lab. Engineering Research Div.
AN EVALUATION OF THREE GRAPHICS PACKAGES: THE METHODOLOGY AND RESULTS Abstract Only
Brian K. Cabral *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 24 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

N86-11871# Los Alamos National Lab., N. Mex. Analysis and Testing Group.
INTERACTIVE GRAPHICS FOR FINITE ELEMENT PREPROCESSING Abstract Only
W. Rob Oakes, Jr. *In its* 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 24 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

N86-11874# Sandia Labs., Albuquerque, N. Mex.
MICROCOMPUTER CONTROL AND DATA MANAGEMENT TECHNIQUES FOR TRANSIENT DIGITAL RECORDING Abstract Only
David A. Benson and Gary D. Miller *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 39 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

N86-11875# California Univ., Livermore. Lawrence Livermore Lab. Nuclear Energy Systems Div.
A DATA TRANSLATOR FOR ENGINEERING MEASUREMENTS Abstract Only
Mel Wieting and Robert M. Trusty *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 40 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

N86-11876# California Univ., Livermore. Lawrence Livermore Lab. Engineering Research Div.
SIG: A GENERAL-PURPOSE SIGNAL PROCESSING CODE Abstract Only
Darrel L. Lager and Stephen G. Azevedo *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 40-41 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

N86-11992# Joint Publications Research Service, Arlington, Va.
COMPUTER-AIDED DESIGNING, ENGINEERING, PREPARATION OF PRODUCTION
Yu. I. Topcheyev *In its* USSR Rept.: Sci. and Technol. Policy (JPRS-UST-85-014) 25 Sep. 1985 p 20-24 Transl. into ENGLISH from Vest. Vysshey Shkoly (Moscow), no. 5, May 1985 p 29-31 (For primary document see N86-11990 02-70)
Avail: NTIS HC A06

62 COMPUTER SYSTEMS

Includes computer networks.

N86-11906*# Michigan Univ., Ann Arbor. Dept. of Electrical and Computer Engineering.
INTEGRATED ANALYSIS OF ERROR DETECTION AND RECOVERY Final Report, 1 Jan. - 31 Dec. 1984
Kang G. Shin and Yann-Hang Lee Oct. 1985 115 p refs
(Grant NAG1-296)
(NASA-CR-172571; NAS 1.26:172571) Avail: NTIS HC A06/MF A01 CSCL 09B

An integrated modeling and analysis of error detection and recovery is presented. When fault latency and/or error latency exist, the system may suffer from multiple faults or error propagations which seriously deteriorate the fault-tolerant capability. Several detection models that enable analysis of the effect of detection mechanisms on the subsequent error handling operations and the overall system reliability were developed. Following detection of the faulty unit and reconfiguration of the system, the contaminated processes or tasks have to be recovered. The strategies of error recovery employed depend on the detection mechanisms and the available redundancy. Several recovery methods including the rollback recovery are considered. The recovery overhead is evaluated as an index of the capabilities of the detection and reconfiguration mechanisms. E.A.K.

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

No abstracts in this category.

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N86-11907*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ON THE IMPLEMENTATION OF A CLASS OF UPWIND SCHEMES FOR SYSTEM OF HYPERBOLIC CONSERVATION LAWS
H. C. Yee Sep. 1985 17 p refs
(NASA-TM-86839; Rept-85412; NAS 1.15:86839) Avail: NTIS HC A02/MF A01 CSCL 12A

The relative computational effort among the spatially five point numerical flux functions of Harten, van Leer, and Osher and Chakravarthy is explored. These three methods typify the design principles most often used in constructing higher than first order upwind total variation diminishing (TVD) schemes. For the scalar case the difference in operation count between any two algorithms may be very small and yet the operation count for their system counterparts might be vastly different. The situation occurs even though one starts with two different yet equivalent representations for the scalar case. Author

N86-11908*# Oklahoma Univ., Norman.
ALGEBRAIC GRID GENERATION USING TENSOR PRODUCT B-SPLINES Ph.D. Thesis
Bonita V. Saunders Sep. 1985 152 p refs
(Grant NGT-47-003-802)
Avail: NTIS HC A08/MF A01 CSCL 12A

Finite difference methods are more successful if the accompanying grid has lines which are smooth and nearly orthogonal. The development of an algorithm which produces such a grid when given the boundary description. Topological considerations in structuring the grid generation mapping are discussed. The concept of the degree of a mapping and how it can be used to determine what requirements are necessary if a mapping is to produce a suitable grid is examined. The grid generation algorithm uses a mapping composed of bicubic B-splines. Boundary coefficients are chosen so that the splines produce Schoenberg's variation diminishing spline approximation to the boundary. Interior coefficients are initially chosen to give a variation diminishing approximation to the transfinite bilinear interpolant of the function mapping the boundary of the unit square onto the boundary grid. The practicality of optimizing the grid by minimizing a functional involving the Jacobian of the grid generation mapping at each interior grid point and the dot product of vectors tangent to the grid lines is investigated. Grids generated by using the algorithm are presented. E.A.K.

N86-11909*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ON SYMMETRIC AND UPWIND TVD SCHEMES
H. C. Yee Sep. 1985 12 p refs
(NASA-TM-86842; Rept-85417; NAS 1.15:86842) Avail: NTIS HC A02/MF A01 CSCL 12A

A class of explicit and implicit total variation diminishing (TVD) schemes for the compressible Euler and Navier-Stokes equations was developed. They do not generate spurious oscillations across shocks and contact discontinuities. In general, shocks can be captured within 1 to 2 grid points. For the inviscid case, these schemes are divided into upwind TVD schemes and symmetric (nonupwind) TVD schemes. The upwind TVD scheme is based on the second-order TVD scheme. The symmetric TVD scheme is a generalization of Roe's and Davis' TVD Lax-Wendroff scheme. The performance of these schemes on some viscous and inviscid airfoil steady-state calculations is investigated. The symmetric and upwind TVD schemes are compared. E.A.K.

N86-11910*# Ohio State Univ., Columbus. Dept. of Geodetic Science and Surveying.
LEAST SQUARES COLLOCATION APPLIED TO LOCAL GRAVIMETRIC SOLUTIONS FROM SATELLITE GRAVITY GRADIOMETRY DATA
John W. Robbins Aug. 1985 105 p refs
(Grant NGR-36-008-161)
(NASA-CR-176299; NAS 1.26:176299; OSU-368) Avail: NTIS HC A06/MF A01 CSCL 12A

An autonomous spaceborne gravity gradiometer mission is being considered as a post Geopotential Research Mission project. The introduction of satellite diometry data to geodesy is expected to improve solid earth gravity models. The possibility of utilizing gradiometer data for the determination of pertinent gravimetric quantities on a local basis is explored. The analytical technique of least squares collocation is investigated for its usefulness in local solutions of this type. It is assumed, in the error analysis, that the vertical gravity gradient component of the gradient tensor is used as the raw data signal from which the corresponding reference gradients are removed to create the centered observations required in the collocation solution. The reference gradients are computed from a high degree and order geopotential model. The solution can be made in terms of mean or point gravity anomalies, height anomalies, or other useful gravimetric quantities depending on the choice of covariance types. Selected for this study were 30 x 30 foot mean gravity and height anomalies. Existing software and new software are utilized to implement the collocation technique. It was determined that satellite gradiometry data at an altitude of 200 km can be used successfully for the determination of 30 x 30 foot mean gravity anomalies to an accuracy of 9.2 mgal from this algorithm. It is shown that the resulting accuracy estimates are sensitive to gravity model coefficient uncertainties, data reduction assumptions and satellite mission parameters. Author

N86-11911*# Hawaii Univ., Manoa. Dept. of Electrical Engineering.
A CASCADED CODING SCHEME FOR ERROR CONTROL
Shu Lin and Tadao Kasami (Osaka Univ., Toyonaka, Japan) 1 Oct. 1985 44 p refs
(Grant NAG5-407)
(NASA-CR-176287; NAS 1.26:176287) Avail: NTIS HC A03/MF A01 CSCL 12A

A cascaded coding scheme for error control was investigated. The scheme employs a combination of hard and soft decisions in decoding. Error performance is analyzed. If the inner and outer codes are chosen properly, extremely high reliability can be attained even for a high channel bit-error-rate. Some example schemes are studied. They seem to be quite suitable for satellite down-link error control. Author

N86-11912# Texas Research Inst., Inc., Austin.
FAILURE RATE MODEL FOR CATHODIC DELAMINATION OF PROTECTIVE COATINGS Memorandum Report, Jun. 1983 - Jun. 1984
J. S. Thornton, R. E. Montgomery, and J. F. Cartier 30 May 1985 22 p
(Contract N00014-83-C-2258)
(AD-A157483; NRL-MR-5584) Avail: NTIS HC A02/MF A01 CSCL 12/1

In order to improve the reliability of wet-end sonar components, the mechanisms for cathodic delamination of rubber-to-metal bonds are studied. A quantitative model for the rate of delamination is proposed. This model is based on the kinetics of the many contributing chemical processes as well as diffusion processes which lead to the failure of the protective coating. The model is solved under a set of assumptions which simplify the differential equations. However, a numerical solution to the complete set of equations would be possible. It is concluded that it will be feasible to understand and quantify the failure process in sufficient detail to formulate design specifications for protective coatings on sonar transducers which will extend the service life of equipment. It is also concluded that better testing procedures could be applied in the evaluation of future candidates for polymeric bonding systems. GRA

N86-11913# Princeton Univ., N. J. Dept. of Electrical Engineering and Computer Science.

A NUMERICAL ANALYSIS OF A QUEUE WITH NETWORK ACCESS FLOW CONTROL
D. W. Browning and J. B. Thomas 1985 9 p
(Contract DAAG29-82-K-0095; Grant NSF ECS-83-17777)
(AD-A157526; ARO-18985.19-EL) Avail: NTIS HC A02/MF A01 CSCL 12/2

A network access flow control method is considered where messages are sent to the nodes which are major users of a congested queue. The model is based on a Markovian queue embedded in the network, and analysis takes place on a sequence of fixed-length time intervals. Changes of state reflecting the control and resulting input rates occur at the ends of the intervals, and the evolution of state probabilities over the course of an internal is analyzed numerically using Euler's method with Richardson extrapolation. The results provide insight into both transient and steady-state behaviors. GRA

N86-11914# Stanford Univ., Calif. Systems Optimization Lab.
SPARSE QUASI-NEWTON METHODS AND THE CONTINUATION PROBLEM
F. F. Chadee Jun. 1985 134 p
(Contracts N00014-85-K-0343; DE-AM03-7 Grants NSF DMS-84-20623; NSF DMS-84-04121)
(AD-A157587; SU-SOL-85-8) Avail: NTIS HC A07/MF A01 CSCL 12/1

The problem of tracing a smooth path arises in many engineering problems, the solution of parametric differential equations and eigenvalue problems; it also finds application in the solution of nonlinear systems of equations by homotopy techniques. In many instances, the path is defined implicitly as the solution of a system of equations whose Jacobian matrix is large and sparse. Robust simplicial path-following techniques cannot be applied to large problems since the work involved rises rapidly with increasing dimension. This dissertation addresses the numerical problems involved in tracing the path for large sparse systems by the use of a predictor-corrector algorithm. We investigate the use of sparse quasi-Newton techniques to reduce the expense of the convector phase of the predictor-corrector algorithm inherent in Newton's method. In order to avoid the drawbacks of the sparse Broyden method - the need for a matrix factorization on each iterate and the need to store both the Jacobian matrix and its factors - we examine techniques for directly updating the LU factors of the approximation to the Jacobian matrix. Under reasonable assumptions on the systems of equations to be solved, a proof of local Q-superlinear convergence is presented for two sparse updating techniques. A predictor-corrector algorithm employing these sparse updating techniques is implemented in a Fortran code and numerical results are obtained demonstrating the advantages to be gained from the use of quasi-Newton methods for the large sparse continuation problem. GRA

N86-11915# Maryland Univ., College Park. Center for Automation Research.
COMPUTATION OF MINIMAL ISOVIST SETS
M. F. Doherty Sep. 1984 89 p
(Contract DAAK70-83-K-0018)
(AD-A157624; CAR-TR-87; CSC-TR-1430) Avail: NTIS HC A05/MF A01 CSCL 12/1

A minimal isovist set (MIS) of a simple polygonal region P is a smallest set of points in P whose union of isovists equals P (where the isovist of x is the set of all points visible from x). This thesis represents an algorithm to search for an MIS for an arbitrary P. An MIS is shown to be equivalent to a minimal covering of P with star-shaped polygons. A (non-complete) algorithm to find a minimal covering is proposed which uses the vertices of the kernels of the star-shaped polygons. The complexity of finding an MIS is reduced to a worst-case consideration of no more than n to the 4th power points in P. A comparison of the proposed algorithm with two previously published algorithms is made. Extension of this method to exterior views and interior holes is discussed, and areas for future research are mentioned. Author (ESA)

N86-11552# Martin Luther-Universitaet, Halle-Wittenberg (East Germany). Sektion Mathematik.
ON INVERSE PROBLEMS IN DIFFERENTIAL EQUATIONS: A CRITICAL ANALYSIS
Gottfried Anger *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth 1985 p 38-44 refs (For primary document see N86-11549 02-42)
Avail: NTIS HC A09/MF A01

N86-11562# Agricultural Univ., Wroclaw (Poland). Dept. of Geodesy and Photogrammetry.
ADJUSTMENT OF THE LATITUDE DATA BY LEAST-SQUARES COLLOCATION APPROACH
R. Galas *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth 1985 p 139-141 refs (For primary document see N86-11549 02-42)
Avail: NTIS HC A09/MF A01

N86-11573# Technische Univ., Dresden (East Germany).
TREATMENT OF THE GEODETIC BOUNDARY VALUE PROBLEM BY CONTACT-TRANSFORMATION
Wolfgang Keller *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 2 1985 p 32-35 refs (For primary document see N86-11568 02-42)
Avail: NTIS HC A09/MF A01

N86-11704# Karlova Univ., Prague (Czechoslovakia). Inst. of Geophysics.
ON THE ADDITION THEOREM FOR LEGENDRE POLYNOMIALS
Oldrich Novotny *In* Ceskoslovenska Akademie Ved Geophys. Works, 1982, Vol. 30 1985 p 33-45 refs (For primary document see N86-11702 02-46)
Avail: Issuing Activity

N86-11715# Ceskoslovenska Akademie Ved, Prague. Inst. of the Physics of the Atmosphere.
ON THE INSTABILITY OF VORTEX SERIES
Jiri Horak *In its* Geophys. Works, 1982, Vol. 30 1985 p 269-285 refs (For primary document see N86-11702 02-46)
Avail: Issuing Activity

N86-11865# California Univ., Livermore. Lawrence Livermore Lab. Engineering Research Div.
PARTICLE PUSHING TECHNIQUES FOR USE WITH FINITE ELEMENT BASED FIELD CALCULATIONS Abstract Only
John C. Peterson *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 12 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

No abstracts in this category.

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

No abstracts in this category.

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

No abstracts in this category.

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N86-11916 Texas Univ., Austin.
THE VACUUM IN THE PRESENCE OF ELECTROMAGNETIC FIELDS AND ROTATING BOUNDARIES Ph.D. Thesis
Corinne Alison Manogue 1984 155 p
Avail: Univ. Microfilms Order No. DA8513258

Two investigations of the properties of the vacuum are made. The first is a reconsideration of the classic Klein paradox, particle creation due to the presence of very strong external electromagnetic potentials. Expectation values of the current, momentum, and number operators, each of which is a measure of particle creation, are calculated for both massive spin zero and massive spin one half fields. The relationship between super-radiance and pair creation is explained. The second investigation concerns the rotation of the vacuum caused by the rotation of boundaries. Just as the presence of boundaries can create a change in the vacuum expectation value of the energy density (the Casimir effect), the rotation of such boundaries can create changes in the vacuum expectation value of the momentum density. Calculations of the Casimir effect are made for a massless scalar field confined to an infinitely long square box. The change in the vacuum expectation value of the momentum density is calculated if this same box is rotating around its long central axis. In contrast, it is shown that for an infinitely long circular cylinder there is no change in the momentum density. Dissert. Abstr.

N86-11917 Clarkson Univ., Potsdam, N.Y.
MAGNETIC FILTRATION Ph.D. Thesis
Mayuree Natenapit 1985 131 p
Avail: Univ. Microfilms Order No. DA8512141

A theory for capture of magnetic particles by a bed of spheres in high gradient magnetic separation (HGMS) is presented. The studies are divided into microscopic and submicroscopic regimes according to the size of particles being filtered. In the former, two cases were considered, one where the carrier fluid can be described by ideal inviscid potential flow, and the other for carrier fluid in creeping or laminar flow. An effective medium treatment (EMI) is employed to determine the fluid velocity profile around a representative sphere in the assemblage. The same approach is used to model the magnetic field, thus taking into account the magnetic effects of neighboring spheres. Results for capture efficiency are reported for both paramagnetic and diamagnetic particles by a filter operating either in the longitudinal or transverse design mode. Dissert. Abstr.

N86-11918# Joint Publications Research Service, Arlington, Va.
CHINA REPORT: SCIENCE AND TECHNOLOGY
2 May 1985 110 p refs Transl. into ENGLISH from various Chinese articles
(JPRS-CST-85-014) Avail: NTIS HC A06/MF A01

Progress in science and technology in the People's Republic of China is reported. Topics discussed include: applied sciences, life sciences, environmental quality, astronautics, lasers, nuclear engineering, phyiscs, and semiconductors. For individual titles, see N86-11919 through N86-11943.

N86-11919# Joint Publications Research Service, Arlington, Va.
DOUBLE TEARING MODE IN PLASMA WITH MAGNETIC BRAIDING c75
Jiaqi Dong *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-014) 2 May 1985 p 28-39 refs Transl. into ENGLISH from Wuli Xuebao (Beijing), v. 33, no. 10, Oct. 1984 p 1341-1349 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

Due to the presence of low amplitude magnetic disturbances in a magnetically confined plasma, the magnetic lines are often twisted into a braid, called magnetic braiding. This type of braided magnetic field structure was investigated. It is suggested that it is possible cause for many phenomena observed in a tokamak plasma like anomalous electron heat conduction, fracture instability, and the behavior of escaped electrons. The heating made caused by anomalous electron viscosity as a possible cause of fracture instability was examined. The linear behavior of resistance double tearing made caused by electron anomalous viscosity is studied. E.A.K.

N86-11920# Joint Publications Research Service, Arlington, Va.
DESIGN OF MANEUVERABLE TRAJECTORIES OF RE-ENTRY VEHICLE Abstract Only c18
Xanuyan Zhao *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-014) 2 May 1985 p 72 Transl. into ENGLISH from Yuhang Xuebao (Beijing), no. 1, 31 Jan. 1985 p 1-10 Original language document announced in IAA as A85-42776 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

This paper mainly discussed the design of maneuverable trajectories of reentry vehicles. Two methods are discussed. The first one is to design optimal maneuverable trajectories by means of the optimal control theory. The method for calculating optimal reentry maneuverable trajectories in this paper is simple and easy, and requires less time. The second one is to attain the engineering design method of selecting reentry maneuverable trajectories from the requirement for terminal velocity to be maximal under the condition of considering the effect of attack angle on drag coefficient. The calculated results show that the deviation of trajectories designed by these two methods is not much; thus, the method of engineering design is feasible. Author (IAA)

N86-11921# Joint Publications Research Service, Arlington, Va.
ONE-DIMENSIONAL TWO-PHASE FLOW IN COMBUSTION CHAMBER OF SOLID PROPELLANT ROCKET MOTORS Abstract Only c20
Xianqi Chang *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-014) 2 May 1985 p 73 Transl. into ENGLISH from Yuhang Xuebao (Beijing), no. 1, 31 Jan. 1985 p 11-23 Original language document announced in IAA as A85-42777 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

In this paper, a numerical solution of basic equations for one dimensional two phase nonequilibrium flow in combustion chambers of solid propellant rocket motors is discussed in detail. The effect of particle size on the flow field in a chamber and pressure time curves is analyzed, and some useful conclusions are obtained in comparison with results of one dimensional two phase constant lag flow in a chamber. It is useful for predicting pressure time curves accurately and providing accurate boundary conditions for the calculation of two phase flow through a nozzle. Author (IAA)

N86-11922# Joint Publications Research Service, Arlington, Va.
ELECTRIC OR MAGNETIC DIPOLE IN STRATIFIED UNIAXIALLY INHOMOGENEOUS ANISOTROPIC MEDIA Abstract Only c32
Jiasheng Wang *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-014) 2 May 1985 p 74 Transl. into ENGLISH from Yuhang Xuebao (Beijing), no. 1, 31 Jan. 1985 p 24-34 Original language document announced in IAA as A85-42778 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

A formulation for calculating the electromagnetic field in an arbitrary layer in terms of the primary source excitation in a stratified homogeneous media is outlined. The source can be an electric or magnetic dipole which oriented in arbitrary direction. This formulation is generalized for stratified uniaxially in-

homogeneous and anisotropic media. This problem is facilitated by decomposing a general wave field into TE and TM modes. The procedure for calculation is discussed and some examples are presented. Author (IAA)

N86-11923# Joint Publications Research Service, Arlington, Va.
PROPAGATION OF ELECTROMAGNETIC WAVES IN INHOMOGENEOUS AND LOSSY REENTRY PLASMA SHEATH LAYER Abstract Only c32
Boyi Wang, Yanhou Xu, and Zhenyu Ji *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-014) 2 May 1985 p 75 Transl. into ENGLISH from Yuhang Xuebao (Beijing), no. 1, 31 Jan. 1985 p 35-46 Original language document announced in IAA as A85-42779 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

This paper presents a theoretical method to analyze the propagation characteristics of the electromagnetic waves through a reentry plasma sheath layer, which is based on the stratified layer model and invariant imbedding principle. The power transmission and reflection coefficients of electromagnetic waves are calculated. The theoretical results are in good agreement with the actual measurements in flight. The advantages of this method are: (1) the physical concepts are clear and direct viewing; (2) formulas are simple; and (3) its applicability is powerful. The computers program in this paper is applicable to any case of the thickness of the sheath layer, the distributions of the electronic density and electronic collision frequency, and the stratified layer media. Author (IAA)

N86-11924# Joint Publications Research Service, Arlington, Va.
PRESSURE-COUPLED RESPONSE FUNCTION OF SOLID PROPELLANTS INCLUDING THOSE WITH NEGATIVE PRESSURE-EXPONENTS Abstract Only c28
Wengan Xu *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-014) 2 May 1985 p 76 Transl. into ENGLISH from Yuhang Xuebao (Beijing), no. 1, 31 Jan. 1985 p 47-58 Original language document announced in IAA as A85-42780 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

A new pressure coupled response function of solid propellants has been theoretically derived using a combustion response model based on the steady state burning of composite solid propellants, including those with negative pressure exponents. In this model, the burning surface of a given propellant is divided into one part consisting of a region of the AF surface covered by molten binder with a corresponding binder surface and another part consisting of a region of the AP surface uncovered by molten binder with the remaining binder surface. The covered part of the surface is analyzed taking the condensed phase reaction and the gasification of covered AP into consideration. The results calculated by the derived pressure coupled response function for 504-5A propellant are in reasonable agreement with experimentally observed behavior. C.D. (IAA)

N86-11925# Joint Publications Research Service, Arlington, Va.
THE ANALYSIS AND CALCULATION FOR THE DYNAMIC CHARACTERISTICS OF THE OMNI-AXIAL MOVABLE FLEXIBLE JOINT NOZZLE Abstract Only c20
Shixue Yang *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-014) 2 May 1985 p 77 Transl. into ENGLISH from Yuhang Xuebao (Beijing), no. 1, 31 Jan. 1985 p 59-77 Original language document announced in IAA as A85-42781 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

In this paper, an analysis and calculation for the dynamic characteristics of the omni axial movable flexible joint nozzle are presented under simulated motor chamber pressure. It mainly consists of the analysis and calculation using measured data, the transient pivot point, and the vector moments. Moreover, the following parametes are calculated: the vector angle, the sweeping speed, the vector azimuth, the length of actuator, the thrust misalignment and the axial/radial displacements of the nozzle under the different pressure. The calculating method is suitable for the firing test with transducers mounted correctly, and it is suitable to measure and calculate the characteristics of the flexible joint in the neutral position. Author (IAA)

N86-11926# Joint Publications Research Service, Arlington, Va.
TRANSITION EFFECTS OF BOUNDARY LAYER ON STATIC AND DYNAMIC STABILITY OF SLENDER CONE Abstract Only c02
Hongtian Lou *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-014 2 May 1985 p 78 Transl. into ENGLISH from Yuhang Xuebao (Beijing), no. 1, 31 Jan. 1985 p 88-98 Original language document announced in IAA as A85-42783 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

This paper presents the experimental technique of transition effects of boundary layer on static and dynamic stability of a slender cone and analyzes its result. The experimental results show that the effects of Re number on static and dynamic stability of slender cone are very important. The variation of Re number induces a change in the position of the natural transition of the boundary layer in the cone face; thus, the induced moment and the induced damping moment of the transition are changed. When the transition exists on the surface of the afterbody of the cone, there is a great increase in dynamic stability and a great decrease in static stability; on the other hand, when the transition occurs forward of the center of gravity, there is some decrease in dynamic stability and some increase in static stability. Author (IAA)

N86-11927# Joint Publications Research Service, Arlington, Va.
RESEARCH ON OPTIC SPATIAL FREQUENCY ANALYSIS OF LINEAR STRUCTURES IN REMOTE SENSING IMAGES Abstract Only c43
Ziqiang Zhu, Zhenpei Chen, Jitao Li, and Guangjie Tang *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-014) 2 May 1985 p 79 Transl. into ENGLISH from Zhongguo Jiguang (Shanghai), v. 12, no. 1, 20 Jan. 1985 p 1-5 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

The fundamental principle and experimental method for spatial frequency analysis of the linear structures in remote sensing images are described. The faint geologic structures in the ERTS image of Yanting County, Sichuan Province, were analyzed by the method, and useful results are obtained. E.A.K.

N86-11928# Joint Publications Research Service, Arlington, Va.
FREQUENCY-SELECTION AND MODE-LOCKING AND Nd:YAG LASER Abstract Only c36
Guichen Tan and Peixia Qiu *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-014) 2 May 1985 p 80 Transl. into ENGLISH from Zhongguo Jiguang (Shanghai), v. 12, no. 1, 20 Jan. 1985 p 11-14 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

Mode-locking of Nd:YAG laser was achieved at four spectral lines (1.052 micron, 1.061 micron, 1.064 micron and 1.073 micron) by inserting prisms as dispersion elements in the cavity. The calculations on prisms are consistent with the experimental results. The stable output wavelength of the laser is obtained. E.A.K.

N86-11929# Joint Publications Research Service, Arlington, Va.
A LARGE AREA X-RAY SOURCE AND ITS PREIONIZATION CHARACTERISTICS FOR XeCl EXCIMER LASER Abstract Only c36
Qihong Lou, Runwen Wang, and Xusan Cheng *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-014) 2 May 1985 p 81 Transl. into ENGLISH from Zhongguo Jiguang (Shanghai), v. 12, no. 1, 20 Jan. 1985 p 19-21 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

A large area cold cathode diode X-ray source and its performances and dosage distribution along with the laser tube and the effects of X-ray intensity on the laser output energy were investigated experimentally. E.A.K.

N86-11930# Joint Publications Research Service, Arlington, Va.
RING CAVITY CO2 LASER FOR BRANCH-SELECTION AND NARROW RESONANCE PRODUCED BY SF6 IN CAVITY Abstract Only **c36**
Yongkai Huang and Jianmin Rong *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-014) 2 May 1985 p 82 Transl. into ENGLISH from Zhongguo Jiguang (Shanghai), v. 12, no. 1, 20 Jan. 1985 p 25-28 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

A new type of branch-selected ring CO2 laser is described. Laser output at the vibration-rotation lines was obtained at 9.5 micron and 10.6 micron. The narrow resonance behavior of SF6 in the cavity is observed. E.A.K.

N86-11931# Joint Publications Research Service, Arlington, Va.
Pb(1-x)Sn(x)Te AND Pb(1-y)Sn(y)Se LASER CRYSTALS Abstract Only **c76**
Xiaochun Zhu, Gendi Cao, and Weizai Zhang *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-014) 2 May 1985 p 84 Transl. into ENGLISH from Zhongguo Jiguang (Shanghai), v. 12, no. 1, 20 Jan. 1985 p 48-50 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

The Pb1- Sub xSn sub xTe and Pb1 - sub ySn sub ySe crystals with the suitable carrier concentration, low dislocation densities and a proper depth of P-N junction are reported. The crystals are directly obtained by a horizontal unseeded vapor growth technique at an appropriate controlling condition for crystal growth. They are used in fabricating the CW tunable diode lasers. E.A.K.

N86-11932# Joint Publications Research Service, Arlington, Va.
PROGRESS OF INERTIAL CONFINEMENT FUSION (ICF) RESEARCH Abstract Only **c75**
Ganchang Wang *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-014) 2 May 1985 p 85 Transl. into ENGLISH from He Kexue Yu Gongcheng (Beijing), v. 4, no. 4, Dec. 1984 p 289-302 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

Progress of inertial confinement fusion (ICF) research is described. Four topics in this field were selected, they are: (1) the cannonball target; (2) high power krypton fluoride (KrF) laser; (3) ion beam diodes; and (4) imploding foil/plasma. E.A.K.

N86-11933# Joint Publications Research Service, Arlington, Va.
STATIONARY PULSE SOLUTIONS FOR A FREE ELECTRON LASER Abstract Only **c36**
Honglie Fang, Shufen Fu, and G. T. Moore *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-014) 2 May 1985 p 88 Transl. into ENGLISH from Wuli Xuebao (Beijing), v. 33, no. 7, Jul. 1984 p 935-942 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

The stationary pulse solutions for a free electron laser are obtained by using the classical theory. Computation shows that the stationary solutions can only be found under certain conditions. The shapes of the solutions do not depend on the shapes of initial optical pulses as long as these conditions are satisfied. E.A.K.

N86-11934# Joint Publications Research Service, Arlington, Va.
THE RELATIONS BETWEEN VOLTAGE AND MAGNETIC FIELD OF SUPERCONDUCTING WEAKLINK (1) Abstract Only **c76**
Yuheng Zhang and Jun Wang *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-014) 2 May 1985 p 89 Transl. into ENGLISH from Wuli Xuebao (Beijing), v. 33, no. 7, Jul. 1984 p 952-958 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

The quantum diffraction of the superconducting weaklink and the quantum interference of the de-SQUID were calculated theoretically based on the constant current source RSJ model. The constant amplitude oscillation of the dc voltage component with magnetic field for double junction de-SQUID is described. E.A.K.

N86-11935# Joint Publications Research Service, Arlington, Va.
THE RELATIONS BETWEEN VOLTAGE AND MAGNETIC FIELD OF SUPERCONDUCTING WEAKLINK (2) Abstract Only **c76**
Yuheng Zhang and Jun Wang *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-014) 2 May 1985 p 90 Transl. into ENGLISH from Wuli Xuebao (Beijing), v. 33, no. 7, Jul. 1984 p 959-966 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

The superconducting weaklink and the influence of the feedback radiation on its I to V curve was studied based on the constant source RSJ model. The analytical solution was obtained and the relationship between the change of the I to V curve and the feedback radiation field intensity from the cavity is given for the case in which the field is very weak. The theoretical results show that the feedback radiation can change the amplitude and shape of V(H), but its period is unchanged. E.A.K.

N86-11936# Joint Publications Research Service, Arlington, Va.
DISCUSSION OF THE SUPERCONDUCTING CRITICAL TEMPERATURE IN A N-S MULTI-FILM STRUCTURE Abstract Only **c76**
Changde Gong, Dingyu Xing, and Mei Liu *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-014) 2 May 1985 p 91 Transl. into ENGLISH from Wuli Xuebao (Beijing), v. 33, no. 7, Jul. 1984 p 967-974 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

The McMillian tunneling model was generalized and applied to a N-S multifilm structure of which the thickness of each film is smaller than the superconducting coherent length. The order parameters and superconducting critical temperature of the structure are calculated, and the possibilities of enhancing T sub by modifying the electron-phonon coupling and contaminating with different atoms in the interface regions are discussed. E.A.K.

N86-11937# Joint Publications Research Service, Arlington, Va.
THEORY OF THE CRITICAL TEMPERATURE FOR SUPERCONDUCTORS WITH SMALL LAMBDA (1) Abstract Only **c76**
Hangsheng Wu and Zhengyu Weng *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-014) 2 May 1985 p 92 Transl. into ENGLISH from Wuli Xuebao (Beijing), v. 33, no. 7, Jul. 1984 p 975-988 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

A formula for the critical temperature of superconductors with small lambda is derived from the Eliashberg equation. The effective phonon spectrum is taken as the Einstein spectrum. The values of T sub c calculated from the formula are compared with the numerical solutions of the Eliashberg equation in the case of mu* = 0 and the agreement between them is fairly well within the region of lambda < lambda. E.A.K.

N86-11938# Joint Publications Research Service, Arlington, Va.
EFFECT OF HIGH ELECTRIC FIELD ON MINORITY CARRIER GENERATION IN SILICON DEPLETION LAYER Abstract Only **c76**
Zhijian Li, Lilin Tian, and Xinrong Ma *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-014) 2 May 1985 p 94 Transl. into ENGLISH from Bandaoti Xuebao (Beijing), v. 6, no. 1, Jan. 1985 p 1-10 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

The effect of high electric field on minority carrier generation was investigated by using MOS C(t) characteristics. A model based on Ieda's theoretical relationship between electron emissivity and field intensity is proposed for simulating the experimental results. This model is successful not only for the experiments of the present work, but also for the reasonable explanation of all experimental nonlinear Zerbst curves. It is concluded that the enhancement of minority carrier generation by electric field should exist in samples of perfect crystal structure and in samples containing high concentration of structural defects. Accompanying the kink of C(V) characteristics of deep depleted MOS structure, a jump in effective surface generation velocity is observed. This phenomenon is related to the electron injection from the valence band of the high impurity

concentration region under the gate into the depletion region by tunneling. E.A.K.

N86-11939# Joint Publications Research Service, Arlington, Va.
DEEP-LEVEL DEFECTS IN ION-IMPLANTED AND CO2 LASER-ANNEALED SILICON Abstract Only c76
Ximao Bao, Xinyu Zhang, and Chengen Liu *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-014) 2 May 1985 p 95 Transl. into ENGLISH from Bandaoti Xuebao (Beijing), v. 6, no. 1, Jan. 1985 p 11-18 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

Seven deep-level traps were found in As-implanted silicon. The CW CO2 laser annealing is an effective method for removing deep-level defects induced by ion-implantation. The available laser power density range is 350 W/sq cm 600 W/sq cm, which is in keeping with that of activation of implanted impurity. A clear slip dislocation was induced by CO2 laser scanning with a power density higher than 600 W/sq cm. The deep level H(0.33 eV) of slip dislocation is measured by DLTS technique. E.A.K.

N86-11940# Joint Publications Research Service, Arlington, Va.
BINDING ENERGY OF DONORS IN GaAs-Ga(1-x) Al(x)As QUANTUM WELL STRUCTURES Abstract Only c76
Zhenping Liu and Tianke Li *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-014) 2 May 1985 p 97 Transl. into ENGLISH from Bandaoti Xuebao (Beijing), v. 6, no. 1, Jan. 1985 p 32-40 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

Binding energies of the ground state are calculated using a variational approach for shallow donors in quantum well structures consisting of a single slab of GaAs sandwiched between two semi-infinite slabs of Ga sub xAl sub As. The binding energy of donors is calculated as a function of GaAs layer thickness and of the impurity position. Two alloy compositions, X = 0.1 and 0.4, are studied and calculated when finite potential barriers determined by realistic conduction band are offset. The results of the present calculations are compared with previous calculations. It is found that the impurity atom is located at the center of the quantum well with composition x = 0.4. When the well thickness L < 50 A, the modification is considerable. The influence of the different effective masses of GaAs and Ga1- sub xAl sub xAs on the ground state binding energy is investigated. E.A.K.

N86-11941# Joint Publications Research Service, Arlington, Va.
AN INTERFACIAL ANALYSIS OF MoNb-GaAs SCHOTTKY BARRIER DIODES Abstract Only c76
Mingren Yu, Furong Zhu, Xun Wang, Binqi Wang, and Kai Shao *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-014) 2 May 1985 p 100 Transl. into ENGLISH from Bandaoti Xuebao (Beijing), v. 6, no. 1, Jan. 1985 p 55-60 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

The GaAs-Nb-Mo-Au Schottky barrier diodes were fabricated on epitaxial GaAs layers by electron beam evaporation of Nb and then D.C. plasma sputtering of Mo and Au. The compositional depth profiles and the interfacial characteristics of these diodes are measured by XPS associated with Ar ion etching. The results are obtained: the interdiffusion between Au and GaAs can be prevented if the thickness of the sputtered Mo layer is larger than 1000 A. The pure Nb layer no longer exists as a result of the Mo interdiffusion. This leads to a structural change of the original GaAs-Mo-Au into a GaAs-(Nb, Mo, Ga, As)-Mo-(Mo, Au multilayer. In the transition region of the interface, Mo exists in the metal form, and the Nb atoms form a low valence oxide after chemical reaction with the native oxide on the GaAs surface. The thermal stability of MoNb-GaAs Schottky barrier is better than that of the Mo-GaAs structure is because it is related to the larger heat of formation of the Nb oxides. E.A.K.

N86-11942# Joint Publications Research Service, Arlington, Va.
THERMAL POST-TREATMENT CHARACTERISTICS OF METASTABLE CARRIER CONCENTRATION IN As-IMPLANTED SILICON AFTER TRANSIENT ANNEALING Abstract Only c76
Li Xu, Peixin Qian, Dongyan Hou, Yusheng Wang, Jianhua Yan, and Shengnan Zheng *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-014) 2 May 1985 p 102 Transl. into ENGLISH from Bandaoti Xuebao (Beijing), v. 6, no. 1, Jan. 1985 p 76-81 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

Metastable carrier concentration which exceeds the value of equilibrium solid solubility of arsenic in silicon was obtained in high-dose arsenic-implanted silicon samples by transient annealing with infrared irradiation. The samples were subjected to thermal post-treatments at different temperatures ranging from 20 to 800 C, and it was observed that above 390 C the activated impurity concentrations decrease with the increase of post-treatment time. The samples were investigated by Hall effect measurement, layer-removal technique by anodic oxidation and etching, TEM, RBS and channeling effect technique. The experimental results are shown and the possible mechanism of deactivation of activated arsenic atom is discussed. E.A.K.

N86-11943# Joint Publications Research Service, Arlington, Va.
DEEP LEVELS IN SEMI-INSULATING GaAs Abstract Only c76
Binglin Zhou and Zhengxiu Chen *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-014) 2 May 1985 p 103 Transl. into ENGLISH from Bandaoti Xuebao (Beijing), v. 6, no. 1, Jan. 1985 p 100-103 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

Hall measurements were performed at a temperature range from 180 to 500 K on undoped SI-GaAs crystals. Two kinds of samples were obtained (1) the high-resistivity samples with activation energy of 0.71 to 0.64 eV determined by 0.43 eV; and (2) 0.37 eV determined by EL5 and EL6 levels. The identification of deep levels in middle-resistivity samples is different from that reported before, and the analysis is proven by the heat-treatment experiments. E.A.K.

N86-11944# Brookhaven National Lab., Upton, N. Y.
DESIGN FOR A HIGH FIELD COMBINED FUNCTION SUPERFERRIC MAGNET
R. C. Gupta and G. H. Morgan 1985 2 p refs Presented at the Particle Accelerator Conf., Vancouver, British Columbia, 13 May 1985
(Contract DE-AC02-76CH-00016)
(DE85-014827; BNL-36626; CONF-850504-215) Avail: NTIS HC A02/MF A01

A combined function superferric magnet option was investigated for the Relativistic Heavy Ion Collider (RHIC). The option requires the maximum value of the field in the magnet to be much higher than that achieved in any existing combined function accelerator magnet. A model is presented in which a good field quality can be maintained up to 2T. It is done by carefully designing the yoke structure and positioning the coils in such a way that the iron poles tend to saturate evenly across the gap. A cold iron model might be necessary for this magnet. DOE

N86-11945# Joint Publications Research Service, Arlington, Va.
USSR REPORT: PHYSICS AND MATHEMATICS Abstracts Only
20 Aug. 1985 163 p refs Transl. into ENGLISH from various Russian articles
(JPRS-UPM-85-005) Avail: NTIS HC A08/MF A01

Progress in physics and mathematics is highlighted in this U.S.S.R. report. Topics discussed include: (1) Acoustics; (2) crystals and semiconductors; (3) fluid dynamics; (4) gas dynamics; (5) high-temperature physics; (6) lasers; (7) nuclear physics; (8) optics and spectroscopy; (9) theoretical physics; (10) thermodynamics; (11) logic and game theory; (12) numerical analysis and algorithms; (13) probability and statistics; (14) control theory; (15) differential equations; and (16) group theory and combinatorics. For individual titles, see N86-11946 through N86-11989.

N86-11946# Joint Publications Research Service, Arlington, Va.
DIFFRACTION OF ULTRASONIC BEAM PASSING NORMALLY

THROUGH LAYERED MEDIA Abstract Only c71
V. S. Konenenko *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 1 refs Transl. into ENGLISH from Fiz. (Tomsk), v. 28, no. 1, Jan. 1985 p 118-119 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

The increase in the velocity and absorption of ultrasound passing through media with different acoustic parameters normal to the interface of the media is assessed analytically. Expressions are derived for the boundary conditions for finding the velocity potentials in the media. The diffraction error occurring in measurements of ultrasound absorption in liquids which use delay lines is analyzed as an example. The analysis shows that diffraction errors can be small in spite of substantial diffraction divergence of the ultrasonic beam in delay lines. Author

N86-11947# Joint Publications Research Service, Arlington, Va.
SPEED OF SOUND IN LIQUID SODIUM NEAR GAMMA-TRANSITION POINT Abstract Only c71
D. L. Timrot, M. A. Serednitskaya, and T. D. Chkhikvadze *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 1-2 refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 279, no. 3, Nov. 1984 p 617-621 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

This study investigates the speed of sound, which is an accurately measurable characteristic of the behavior of liquid sulfur that changes abruptly at about 432 K, which is called a gamma-transition point. The speed of sound is measured at temperatures of 361 to 493 K, which surrounds the special point and includes a region not investigated previously. The measurements were made by fixed-distance echo pulsation. The precision of the experiment made it possible to establish a singular point in the behavior of the parameter in question as a function of temperature. This point, at which the temperature coefficient of the speed of sound changes abruptly, is approximately 432 K. Analysis of the temperature dependency of he adiabatic and isothermic compressibility also made it possible to identify a singular point in the behavior of adiabatic compressibility at the gamma-transition temperature.
Author

N86-11948# Joint Publications Research Service, Arlington, Va.
RAMAN SCATTERING OF SOUND ON RANDOM OSCILLATIONS OF BUBBLES Abstract Only c71
Ye. A. Zabolotskaya *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 2 ref Transl. into ENGLISH from Kratk. Soobshch. po Fiz. (Moscow), no. 10, 1984 p 23-25 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

This study investigates the Raman combination frequencies that occur when acoustic waves propagating in a medium containing distributed gas bubbles are scattered on the latter because of nonlinearity of the motion equation of the bubble. The spectral density of the combination-frequency scattered wave is estimated by sequential approximation. It is found that the determining role in Raman scattering of sound on bubbles is played by random forces, random noise and vibrations, the leading edge of the acoustic perturbation and non-steady-state movement when the bubbles are formed, etc. The frequency and spectral density of the oscillations of the volume of bubbles can be found from the Raman scattering spectrum. Author

N86-11949# Joint Publications Research Service, Arlington, Va.
DETERMINATION OF PARAMETERS OF ELASTIC SPHERICAL SHELL FROM SCATTERED WAVE FIELD Abstract Only c71
A. V. Sergeyev *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 2-3 refs Transl. into ENGLISH from Akust. Zh. (Moscow), v. 31, no. 1, Jan.-Feb. 1985 p 96-102 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

This study investigates the possibility of constructing a structurally simple algorithm for determining the parameters of an elastic spherical shell in a liquid that uses the space-frequency processing of the field scattered by the shell. The characteristics of the surrounding medium are assumed to be known. A plane harmonic wave is incident on the shell; the space-frequency distribution of the field scattered by the shell is measured. The proposed algorithm is modeled on an ES1022 computer for a water-filled aluminum shell with $h/R = 0.02$. Investigations indicate that registering the field on a spherical surface concentric with the spherical shell is most effective in terms of measurement error. Author

N86-11950# Joint Publications Research Service, Arlington, Va.
STABILITY OF A METHOD FOR ANALYZING RADIATION PATTERN OF ACOUSTIC RADIATOR WITH NEAR-FIELD PRESSURE MEASUREMENT ERRORS Abstract Only c71
I. Ye. Tsukernikov *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 3 refs Transl. into ENGLISH from Akust. Zh. (Moscow), v. 31, no. 1, Jan.-Feb. 1985 p 111-113 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

Two constraints are derived that facilitate the uniform convergence of the approximate solution of the integral equation for the distribution of the normal component of the oscillatory rate to its exact value. Both constraints are derived as the result of linearizing hydrodynamic equations, and therefore can be viewed as a stability criterion for the solution of the equation of the first kind in linear acoustics. It is shown by solving test problems that the algorithm presented in a previous study by the author for solving the integral equation satisfies both constraints automatically. The findings are illustrated by calculating the radiation pattern of an antenna consisting of five phased point acoustic sources spaced with a period of gamma/4 on the axis of rotation of the measurement cylinder surrounding the antenna. Author

N86-11951# Joint Publications Research Service, Arlington, Va.
REFLECTION OF SOUND FROM PLATE CONTAINING PERIODIC INHOMOGENEITIES Abstract Only c71
A. D. Lapin *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 5-6 refs Transl. into ENGLISH from Akust. Zh. (Moscow), v. 31, no. 1, Jan-Feb. 1985 p 73-76 Previously announced in IAA as A85-41647 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

The scattering of sound by a thin plane elastic plate with small periodic inhomogeneities is investigated analytically, extending the theory developed by Lapin (1984) for a wall with elastic-reactance acoustic impedance. An equation describing the vibration of the plate is derived, and the problem of the conversion of bulk waves to surface waves is solved by combining the free and forced solutions for an infinite periodic structure. Allowance is made for the three-mode interactions, and the inclusion of higher-level interactions is shown to have no significant effect on the results. T.K. (IAA)

N86-11952# Joint Publications Research Service, Arlington, Va.
CONVERSION OF ELECTROMAGNETIC WAVE ENERGY TO ELECTRICAL CURRENT BY BULK SUPERLATTICE SEMICONDUCTORS Abstract Only c76
M. M. Kechiyev, A. A. Kostenko, V. D. Kurek, O. A. Kuznetsov, V. A. Tolomasov, O. N. Filatov, G. I. Khlopov, and V. P. Shestopalov *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 7 refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 279, no. 3, Nov. 1984 p 606-608 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

This study describes the experimentally observed phenomenon of conversion of millimeter-band electromagnetic wave energy to direct current by bulk superlattice semiconductors. The specimens investigated consisted of multilayer heteroepitaxial structures consisting of three hundred layers of pure germanium and a solid solution of germanium and silicon, alternating with a period of 175 A. The voltage-power sensitivity of the specimen is analyzed as a function of the electrical dc bias and the microwave power level, and the equivalent noise power is found as a function of

the electrical dc bias. Analogous experiments were made for comparison using commercially produced type D404 microwave diodes, confirming a fundamental difference between the semiconductors in question and semiconductor devices with gate-type response. Author

N86-11953# Joint Publications Research Service, Arlington, Va.
CAUSE OF OCCURRENCE OF HIGH-ENERGY IONS DURING UV LASER IRRADIATION OF MOLECULAR CRYSTALS Abstract Only c76
S. Ye Yegorov and A. N. Shibanov *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 7-8 refs Transl. into ENGLISH from Zh. Teckh. Fiz. (Leningrad), v. 54, no. 11, Nov. 1984 p 2270-2274 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

High-energy ions (up to several keV) form during pulse laser irradiation of the surface of solids at intensities of 10 to the 4th power to 10 to the 6th power UV sq cm. It is shown that high ion kinetic energy is associated with the occurrence of a potential on the surface of the specimen due to the external photoelectric effect. The investigations were performed on a transit-time mass spectrometer coupled with a storage oscilloscope with 50 MHz range. The behavior of anthracene and adenine ions is compared. It is found that ions formed near the surface of the crystal in the center of the irradiated area acquire significantly more additional energy than ions formed away from the center of the irradiated area. The conclusion reached elsewhere that ions where high kinetic energies cannot be formed in the gaseous phase is refuted. Author

N86-11954# Joint Publications Research Service, Arlington, Va.
HYDRODYNAMICS OF LIQUID-VAPOR DISPERSE ANNULAR FLOWS IN CHANNELS CONTAINIG BUNDLES OF HEATED RODS UNDER NONSTEADY-STATE CONDITIONS Abstract Only c34
A. Ye. Kroshilin, V. Ye. Kroshilin, and B. I. Nigmatulin *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 10 refs Transl. into ENGLISH from Teplofiz. Vys. Temp. (Moscow), v. 22, no. 5, Sep. - Oct. 1984 p 933-940 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

A one-dimensional nonsteady-state hydrodynamic model is developed for liquid-vapor disperse annular flows in channels containing bundles of heated rods, (e.g., water-cooled nuclear fuel rods). The cross-section of the channel is divided into cells; continuity equations are derived for the gas-phase, liquid-film and droplet components of the mixture. A system of linear algebraic equations is derived for the unknown crossover flows and the pressure gradient along the channel. The model is used to predict the time between the drying up of the fluid layer near a heated rod and the onset of a heat release emergency, and the results agree satisfactorily with experimental findings. Author

N86-11955# Joint Publications Research Service, Arlington, Va.
TOWARD A THEORY OF ATOMIC GAS BREAKDOWN BY LASER RADIATION NEAR A METAL SURFACE Abstract Only c36
V. S. Vorobev and A. L. Khomkin *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 13 refs Transl. into ENGLISH from Fiz. Plazmy (Moscow), v. 10, no. 5, Sep. - Oct. 1984 p 1025-1032 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

The threshold intensity of laser radiation causing the breakdown of atomic gases near a metal surface is investigated as a function of the kind of metal and gas, pressure and radius of focusing spot. The initial stage of breakdown is viewed as a clearly defined transition from the state of a gas with a very low degree of vapor ionization to a state with considerable ionization. This transition is determined by the relationship between the generation of electrons in ionization events and diffusion losses. The average electron energy and diffusion loss radius are found through two-dimensional balance equations written for a cylindrical geometry at a given surface temperature with allowance for the process of ionization and recombination, ambipolar diffusion, heat conductivity, elastic and nonelastic electron energy loss, and absorption of laser radiation energy. The laser radiation intensity is found for which ionization and recombination processes predominate over diffusion losses near the surface. The intensities thus derived are compared with experimental data for different gases and metals. Author

N86-11956# Joint Publications Research Service, Arlington, Va.
INITIAL PLASMA FORMATION DURING EXPOSURE OF ABSORBING MATERIALS TO LASER RADIATION WITH PLANE EXPANSION GEOMETRY OF THE FORMING PLASMA Abstract Only c75
L. Ya. Minko, Yu. A. Chivel, and A. N. Chumakov *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 14-15 Transl. into ENGLISH from Zh. Prikl. Spektrosk. (Minsk), v. 42, no. 1, Jan. 1985 p 55-61 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

This study describes experimental investigations of unsteady processes of initial plasma formation, and analyzers the role of erosion and air plasma in the formation of the screening plasma plane. Complex experiments employing high speed shadow, photographic and spectrographic methods, as well as photoelectric recording of the incident and reflected laser radiation, were conducted. A Q-modulated neodymium glass laser producing from 10 to 700 MW/cm at gamma = 1.06 micrometers (tau approx. 0.0000015) sub s was the source of moderate-intensity laser radiation directed at the absorptive targets. The plasma formation times were determined to within approximately 20 ns for aluminum, zinc, bismuth and ebonite. An erosion mechanism is found to decribe initial plasma formation; the screening of the target that may develop under certain additional conditions does not occur. The initial formation of an erosion laser plasma is found to be accompanied by the occurrence of turbulence that includes the entire plasma formation in many cases, including the moving shock wave front. Author

N86-11957# Joint Publications Research Service, Arlington, Va.
LASER EVAPORATION OF METAL IN GASEOUS ATMOSPHERE Abstract Only c36
V. I. Igoshin and V. I. Kurochkin *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 15 refs Transl. into ENGLISH from Kvantovaya Elektron. (Moscow), v. 11, no. 8, Aug. 1984 p 1555-1561 Previously announced in IAA as A85-19247 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

A gasdynamic theory is presented of the evaporation of metals by laser radiation in a wide range of external pressures for power densities of 1 to 100 MW/sq cm. The boundary between the supersonic gasdynamic and the diffusive evaporation regimes is established. The results of numerical calculations of the evaporation of aluminum and iron are presented. Author (IAA)

N86-11958# Joint Publications Research Service, Arlington, Va.
INFLUENCE OF SOLID STATE OBSTACLES ON RADIATION OF RECOMBINATION LASER PLASMA Abstract Only c75
V. A. Boyko, B. A. Bryunetkin, F. V. Bunkin, V. I. Derzhiyev, V. M. Dyakin, S. A. Mayorov, I. Yu. Skobelev, A. Ya. Fayenov, A. I. Fedosimov, and K. A. Shilov *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 16-17 refs Transl. into ENGLISH from Fiz. Plazmy (Moscow), v. 10, no. 5, Sep. - Oct. 1984 p 999-1009 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

The influence of solid-state obstacles on the separation dynamics of laser plasma is investigated. It is found observationally, analytically and through modeling that obstacles influence the nature of plasma flow by changing such hydrodynamic parameters as the electron density and temperature. A substantial role is played by phenomena associated with shockwaves; it is sug-

gested that an increase in recombination plasma glow behind the shockwave front is observed. Two groups of experiments are described: one with high intensity achieved by focusing thie laser pulse sharply within a spot 0.1 to 0.4 mm in diameter; and a second with comparatively low intensity, of less than 5 x 10 to the 10th power w/sq cm, obtained by focusing the pulse in a line 2 cm long and 200 m wide. It is found that obstacles increase the glow intensity of ion lines at those distances at which recombination level jumping is realized. The changes in glow intensity occurring during interaction with a cylindrical obstacle can be used to diagnose the electron density by the width of the trough in the glow ahead of the shockwave front. Author

N86-11959# Joint Publications Research Service, Arlington, Va.
SURFACE COMBUSTION OF LIQUID FUEL IN STREAM OF GASEOUS OXIDIZER Abstract Only. c25
N. I. Zverev and V. N. Smirnov *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 22 refs Transl. into ENGLISH from Fiz. Goreniya i Vzryva (Novosibirsk, USSR), v. 20, no. 6, Nov. - Dec. 1984 p 33-38 Original language doc. was announced as A85-25571 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

The problem of the combustion of a plane surface of liquid fuel in a flow with distributed parameters is analyzed for the case where the fuel vapors over the fuel surface react in the kinetic model. The problem is solved in the content of boundary layer theory, with allowance made for the motion induced in the fuel layer and changes in the thermophysical properties of the gas associated with changes in its composition. V.L. (IAA)

N86-11960# Joint Publications Research Service, Arlington, Va.
EXPLOSION WAVES GENERATED BY DEFLAGRATION COMBUSTION Abstract Only c25
V. A. Gorev and S. A. Bystrov *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 P. 22 refs Transl. into ENGLISH from Fiz. Goreniya i Vzryva (Novosibirsk, USSR), v. 20, no. 6, Nov. - Dec. 1984 p 26-33 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

This study presents an analytical solution of the problem of the flow of gas ahead of a spherical combustion front propagating at a constant velocity with the combustion products assumed stationary. The problem is also solved for a cylindrical flame bounded above and below by rigid planes. Equations are derived for the flame- and piston-associated movement of gas expanding at a constant rate. The method is advantageous in that it makes it possible to calculate the gas flow for a wide range of flame velocities, ranging from minimal, corresponding to laminar combustion, to approximately 500 m/sec. Author

N86-11961# Joint Publications Research Service, Arlington, Va.
EXCITATION OF DISCHARGE IN AIR BY LASER RADIATION Abstract Only c36
V. I. Bukatyy, A. A. Kobolov, and A. A. Telnikhin *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 27 refs Transl. into ENGLISH from Zh. Tekhn. Fiz. (Leningrad), v. 55, no. 2, Feb. 1985 p 312-318 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

Experimental findings on the low-threshold breakdown of air by pulse infrared radiation are analyzed. The dynamics of the formation of the discharge and the properties of the low-temperature plasma that is formed are found to depend strongly upon the parameters of the perturbing radiation. The discharge produced in air by a CO2 laser is highly nonequilibrium, while that produced by a neodymium laser is quasiequilibrium. The findings indicate that discharge development in the radiation field of the neodymium laser is thermal in nature. Author

N86-11962# Joint Publications Research Service, Arlington, Va.
INFLUENCE OF PHYSICAL-CHEMICAL PROPERTIES OF GASES ON INTERACTION BETWEEN SHOCKWAVES AND CONVEX CYLINDRICAL SURFACES Abstract Only. c34
L. G. Gvozdeva, Yu. P. Lagutov, and V. P. Fokeyev *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 31 refs Transl. into ENGLISH from Inzhenerno-Fiz. Zh. (Minsk), v. 48, no 2, Feb. 1985 p 239-244 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

The interaction of shockwaves with cylindrical surfaces is investigated in a square shock tube with Mach numbers ranging from 1.5 to 6.0 and initial pressures from 10 to 30 mm Hg. Cylindrical segments with radii 123 mm were employed. Shadowgrams and interferomgrams of the interaction regions were registered in argon, nitrogen and carbon dioxide, which were used to model different depths of physical-chemical transformations in the gas behind the shockwave. The influence of physical and chemical processes on shockwave interaction is described. The changes occurring in the flow picture are similar to those observed on plane wedges. Author

N86-11963# Joint Publications Research Service, Arlington, Va.
CALCULATION OF FORMATION TIME OF MINIMAL NUCLEUS OF FLAME DURING IGNITION OF EXPLOSIVE MIXTURES BY ELECTRICAL DISCHARGES Abstract Only. c25
N. I. Lobyzov and N. M. Karmazinov *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 33 refs Transl. into ENGLISH from Fiz. Goreniya i Vzryva (Novosibirsk, USSR), v. 20, no. 6, Nov. - Dec. 1984 p 55-58 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

The influence of asymmetry on the formation time of the minimal flame nucleus and the sharpness of the maximum of the curve of the discharge power plotted as a function of time are analyzed from the viewpoint of thermal ignition theory. The electrical discharge is replaced by a point heat source with time-varying power; the surrounding medium during the ignition time is chemically inert. It is found that the formation time of the minimal nucleus depends little upon the rate of energy release in the discharge, and is apparently determined, like the dimension of the minimal nucleus of the flame, by the physical-chemical properties of the explosive mixture. The formation time for hydrogen-air and methane-air explosive mixtures is estimated as an example. The analytical and experimental values are found to agree well qualitatively and quantitatively. Author

N86-11964# Joint Publications Research Service, Arlington, Va.
FLAME PROPAGATION IN PULSED ACCELERATION FIELD Abstract Only. c25
V. P. Samsonov *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 33 refs Transl. into ENGLISH from Fiz. Goreniya i Vzryva (Novosibirsk, USSR), v. 20, no. 6, Nov. - Dec. 1984 p 58-61 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

The variation in the velocity and form of a flame initially propagating under weightless conditions in a semi-open tube in a pulsed uniform acceleration field is investigated. Weightlessness is created by dropping a heavy container, within which the reaction tube is held vertically. A camera secured to the container is then used to record the flame. The stability of the flame front is studied. Differences in the change in the flame velocity during upward and downward propagation are explained primarily by different conditions for the development of the flows of cold gas and hot combustion products occurring when the reaction tube is braked, as well as convection currents in the combustion product. Author

N86-11965# Joint Publications Research Service, Arlington, Va.
OCCURRENCE OF PRESSURE WAVE DURING SPONTANEOUS IGNITION OF GAS AHEAD OF FLAME FRONT IN CLOSED VESSEL Abstract Only. c25
V. I. Vodyanik and S. V. Tarakanov *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 36 refs Transl. into ENGLISH from Fiz. Goreniya i Vzryva (Novosibirsk, USSR), v. 21, no. 1, Jan. - Feb. 1985 p 49-53 (For primary document

see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

The basic stages of the propagation of a flame in a closed vessel are analyzed chronologically, starting with frontal combustion, followed by spontaneous combustion and pressure wave formation. The analytical results are tested numerically in a problem of spontaneous ignition and pressure wave formation. The conditions under which spontaneous ignition causes shockwave formation are determined. The peak pressures are found to be significantly higher than the maximum reached during frontal combustion of a gas in a vessel. Evaluation criteria are derived for the possibility of spontaneous ignition, as well as formulas for calculating the shockwave pressure. Author

N86-11966# Joint Publications Research Service, Arlington, Va.
STEADY-STATE DETONATION OF CHARGES OF FINITE LENGTH Abstract Only **c28**
V. K. Ashayev, G. S. Doronin, and V. S. Zhuchenko *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 37 refs Transl. into ENGLISH from Fiz. Goreniya i Vzryva (Novosibirsk, USSR), v. 21, no. 1, Jan. - Feb. 1985 p 127-130 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

The applicability of the steady-state model to short explosive charges is demonstrated with the help of precision optical recordings. The error sources in the free surface method are analyzed, and the findings of two previous studies are interpreted within the framework of classical conceptions. The studies employ compressed trotyl and octogen in charges 10 and 50 mm long initiated by a shockwave. Steady-state detonation is found for 10 mm. Methods based on measuring the attenuation of the velocity of the shockwave front in the barrier can be used to investigate detonation processes using short charges. Author

N86-11967# Joint Publications Research Service, Arlington, Va.
LASING ON VAPORS OF CHAIN COMPOUNDS Abstract Only **c36**
V. V. Gruzinskiy, K. M. Degtyarenko, T. N. Kopylova, and V. T. Pavlova *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 44 p 44 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved.: Fiz. (Tomsk, USSR), v. 28, no. 1, Jan. 1985 p 101-103 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

The lasting properties of a number of organic molecules in the gas phase and in solution are investigated. Effective lasing is achieved on the vapors of new chain-structured organic compounds; replacing a double carbon-carbon bond with a ternary bond improves the lasing characteristics of the active media in the gas phase significantly. Lasing intensity and threshold jumping power density close to the values in a Toluol solution are achieved for 1,4-diphenyl-ethynilbiphenyl. Author

N86-11968# Joint Publications Research Service, Arlington, Va.
ENERGY CHARACTERISTICS OF LASER WITH SATURABLE ANISOTROPIC ABSORBING MEDIUM IN CAVITY Abstract Only **c36**
A. P. Voytovich and V. V. Mashko *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 44-45 refs Transl. into ENGLISH from Zh. Prikl. Spektros. (Minsk, USSR), v. 41, no. 6, Dec. 1984 p 899-904 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

The single-frequency steady-state lasing mode of a laser in which the cavity contains an absorbing medium in the longitudinal magnetic field and elements that create circular phase and linear amplitude anisotropy is investigated theoretically. The influence of various factors on the size of the losses introduced in the laser cavity by the absorbing medium, and the corresponding changes in the intensity of the radiation generated at the frequency of the absorption line, are investigated. The relative change in the absorption lines when a magnetic field is applied to the absorbing medium is calculated as a function of the lasing intensity in the absence of absorption in the cavity. The analytical data show good agreement with experimental values. The findings can be utilized for intracavity laser spectroscopy. Author

N86-11969# Joint Publications Research Service, Arlington, Va.
INVESTIGATION OF EFFICIENCY OF GENERATION OF DIFFERENCE-FREQUENCY LASER RADIATION IN WAVEGUIDE Abstract Only. **c36**
A. O. Makaryan, K. M. Movsisyan, and P. S. Pogosyan *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 45 Transl. into ENGLISH from Zh. Prikl. Spektros. (Minsk, USSR), v. 41, no. 6, Dec. 1984 p 908-911 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

Millimeter wavelength difference-frequency lasing was obtained by mixing the frequencies produced by two temperature-detuned ruby lasers in a LiNbO3 crystal in a rectangular waveguide. The conversion efficiency is studied as a function of the angle of incidence of the exciting beams on the crystal, as well as the angle between the exciting beams and their spatial overlap, at wavelengths of 4 and 8 mm. The experimental findings are in good agreement with the analytical figures. The results can be used in developing lasers, determining the spatial parameters of lasers, etc. Author

N86-11970# Joint Publications Research Service, Arlington, Va.
SPECTRUM STRUCTURE OF XeCl ELECTRIC DISCHARGE LASER Abstract Only **c36**
V. S. Burakov, A. F. Bokhonov, and V. A. Titarchuk *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 46 Transl. into ENGLISH from Zh. Prikl. Spektros. (Minsk, USSR), v. 41, no. 6, Dec. 1984 p 1029-1032 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

The influence of selective cavity elements, intra-cavity absorption, plasma reaction products in the active medium, and components of the electrode material on the spectrum structure of an XeC1 laser is investigated. The investigations employ high spectral resolution (3 x 10 to the 5th power) with widely varying pressure of the active medium, and cavity construction, incorporating a selectively absorbing cell, making it possible to identify the basic factors determining the formation of the lasing spectrum. The occurrence of an interference structure is observed experimentally, and ways of eliminating it are found. The possibility of controlling the spectrum with the help of dispersing elements and a selectively absorbing cell is demonstrated. Selective losses induced by the OH radical could not be eliminated. Author

N86-11971# Joint Publications Research Service, Arlington, Va.
DISTRIBUTED-FEEDBACK LASERS WITH ACTIVE FRAMING MEDIUM Abstract Only. **c36**
Yu. N. Ryzhov, I. V. Cheremiskin, and T. K. Chekhlova *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 47 refs Transl. into ENGLISH from Zh. Prikl. Spektros. (Minsk, USSR), v. 42, no. 1, Jan. 1985 p 48-51 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

This study describes the use of transverse waveguide pumping in thin-film layers employing an active framing medium. With this approach, active particles are excited only in the thin framing layer of the waveguide, which reduces the superluminescence and lasing (non-waveguide) that occurs within the pumped layer. A laser consisting of a 0.06 micron Ta205 film applied to a glass substrate is described. The method by which the active stripline waveguides were prepared is described. The relationship between the laser gain and the waveguide parameters is investigated theoretically, and the laser parameters corresponding to the smallest threshold pumping power are found. The use of alkali-halide crystals with color centers to obtain CW lasing is discussed. The distributed feedback lasers examined require high pumping power density and give off substantial heat in the CW mode.
Author

N86-11972# Joint Publications Research Service, Arlington, Va.
INVESTIGATION OF POLARIZATION CHARACTERISTICS OF RADIATION FROM LASER WITH DYE-ACTIVATED POLYMER ELEMENTS Abstract Only **c36**
V. S. Burakova, N. N. Vasilev, A. Ya. Gorelenko, V. Ye. Sivenkova, and A. P. Shkadarevich *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 48 refs Transl. into ENGLISH from Zh. Prikl. Spektros. (Minsk, USSR), v. 42, no. 1, Jan. 1985 p 35-40 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

The polarization characteristics of a laser with active elements made of oxazine-17 activated polymethylmethacrylate are investigated and compared with the analogous parameters of a laser employing solutions of oxazine-17 in different solvents. The influence of the activator on the properties of the polymer elements activated by complex organic compounds is assessed. The lasing efficiency and degree of polarization during transverse and quasi-longitudinal excitation at the second harmonic (532 nm) of a frequency monopulse YAG laser are determined as a function of the aximuth of the polarization, the power of the exciting light, and the parameters of the cavity of the dye laser. The properties of polymer lasers are found to depend more upon the polarization of the exciting light than dye lasers, which is important when polymer is found to be the fundamental factor determining the efficiency in polarization of the laser. Author

N86-11973# Joint Publications Research Service, Arlington, Va.
HIGH-EFFICIENCY Al SUB 2 O SUB 3:Ti SUP 3+ TUNABLE LASER Abstract Only **c36**
G. S. Kruglik, G. A. Skripko, A. P. Shkadarevich, N. V. Kondratyuk, E. A. Zhdanov, and A. M. Zabaznov *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 48-49 refs Transl. into ENGLISH from Zh. Prikl. Spektros. (Minsk, USSR), v. 42, no. 1, Jan. 1985 p 126-128 Original language doc. was announced at A85-28984 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

A study is made of the lasing characteristics of an A1203:Ti(3+) laser pumped by the second harmonic of a YAG laser. A conversion efficiency of 36 percent (for a differential efficiency of 55 percent) and a tunability range of 680 to 930 nm have been demonstrated. Second harmonic generation in the LilO3 crystal and passive Q-switching at F3(-) color centers in LiF have been achieved. Author

N86-11974# Joint Publications Research Service, Arlington, Va.
ULTRAVIOLET LASING IN HELIUM-NITROGREN MIXTURES Abstract Only **c36**
E. I. Asinovskiy, L. M. Vasilyak, V. V. Markovets, and Yu. M. Tokunov *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 49 refs Transl. into ENGLISH from Zh. Prikl. Spektros. (Minsk, USSR), v. 42, no. 1, Jan. 1985 p 131-134 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

The influence of helium admixtures on ultraviolet lasing (337.1 nm) in a coaxial nitrogen laser is investigated experimentally. The addition of helium expands the region of pressures within which lasing exists, but the lasing intensity drops off. An experimental setup incorporating a glass discharge tube 48.5 cm long and 0.4 cm in diameter is described. Lasing in coaxial lasers is found to be determined basically by the dynamics and parameters of the breakdown waves, regardless of the composition of the gas. The addition of helium makes it possible to increase the overall working pressure of the gas in a nitrogen laser without reducing the peak power of the laser significantly. The laser pulse length is shorter in helium-nitrogen mixtures than in pure nitrogen. The length of the tube must be increased or decreased correspondingly in order to obtain the first or second laser peak for a given pressure. Author

N86-11975# Joint Publications Research Service, Arlington, Va.
ELECTROIONIZATION IR Xe-ATOM LASER Abstract Only **c36**
N. G. Basov, V. A. Danilychev, A. Yu. Dudin, D. A. Zayarnyy, N. N. Ustinovskiy, I. V. Kholin, and A. Yu. Chugunov *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 49-50 refs Transl. into ENGLISH from Kvantovaya Elektronika (Moscow), v. 11, no. 9, Sep. 1984 p 1722-1736 Original language doc. was announced as A85-21003 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

A high-power high-pressure electroionization laser operating at the 5d-6p and 7p-7s transition of the Xe atom and having an active volume of 9 liters is investigated. Expressions are obtained which relate the electrical parameters of the electroionization discharge and the energy parameters and spectral composition of the output radiation to the type of the buffer gas, parameters of the discharge circuit, and the component ratio and pressure of the active medium. When the laser is pumped by an electron beam alone, with a current density of 6 A/sq cm and a pulse length of 0.7 microsec, the output energy is about 6 J (efficiency of about 1.5 percent); under electroionization pumping, the output energy is about 20 J. The physical efficiency of generation due to the electric field is about 5 percent. The mechanism of active medium conductivity and the level population kinetics of the lasing transitions are discussed. Author

N86-11976# Joint Publications Research Service, Arlington, Va.
OPTIMIZATION OF PARAMETERS OF CHEMICAL CO LASER BY INCREASING LENGTH OF ACTIVE MEDIUM Abstract Only **c36**
V. A. Dudkin and V. B. Rukhin *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 51 refs Transl. into ENGLISH from Kvantovaya Elektronika (Moscow), v. 11, no. 9, Sep. 1984 p 1883-1884 Original language doc. was announced at A85-21013 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

Results of an experimental study of a chemical CO laser using a CS2-N2O-O2 flame with an active medium length of up to 3 m are reported. The importance of matching the dimensions of the active medium with the mode structure of the resonator is emphasized. A chemical efficiency of 15 percent has been achieved under 100-W continuous emission. Author

N86-11977# Joint Publications Research Service, Arlington, Va.
EFFICIENCY OF OPTICALLY-PUMPED XeF-LASER Abstract Only **c36**
V. S. Zuyev, L. D. Mikheyev, and D. B. Stavrovskiy *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 55 refs Transl. into ENGLISH from Kvantovaya Elektronika (Moscow), v. 11, no. 9, Sep. 1984 p 1750-1756 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

A discussion is given of the findings from experiments conducted to determine the attainable inner efficiency and technical efficiency values for a photodissociation XeF-laser employing electrical-discharge vacuum UV pumping. The laser investigated employed B-X (353 nm) and C-A (485 nm) transitions in the Xe-F excimer. The possibility of attaining instantaneous efficiency of approximately 1% in discharge-pumped XeF-lasers is confirmed experimentally. The energy efficiency, defined as the ratio of the lasing energy to the energy stored in the condenser battery, can also approach 1%. It is estimated that only about 10R of the energy emitted by the source within the photodissociation band of XeF2 is utilized, considering the temporal behavior of the brightness temperature and the geometric dimensions of the pumping source. The output energy observed is the highest ever recorded for optically pumped XeF lasers. Author

N86-11978# Joint Publications Research Service, Arlington, Va.
ENERGY CHARACTERISTICS OF WAVEGUIDE CO SUB 2-LASER Abstract Only **c36**
Yu. B. Konev, N. I. Lipatov, P. P. Pashinin, and A. M. Prokhorov *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 59-60 refs Transl. into ENGLISH from Kvantovaya Elektron. (Moscow), v. 11, no. 8, Aug. 84 p 1641-1645 (For

primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

This study describes the numerical modeling of a waveguide CO2-laser in the linear amplification and lasing modes by the balance equation method for average numbers of individual mode quanta. The composition of the working medium is assumed to be constant, and allowance is made for quantum flow to levels above the minimum of the Triner distribution function of the assymmetrical CO2-molecule mode caused by the high degree of vibrational excitation of the medium. The approach employed takes into account the effect of surface deactivation of CO2 molecules on the inner walls of the waveguide. Calculations are made for discharge-channel diameters of 1.5 and 2.0 mm. Discharge current values are plotted as a function of the lasing output power and the electromagnetic field intensity in the cavity. It is found that surface deactivation of the excited mixture can cause substantial losses of vibrational V3-mode energy of CO2 and N2, particularly when the active medium pressures are comparatively low. Author

N86-11979# Joint Publications Research Service, Arlington, Va.
CHROMIUM- AND NEODYMIUM-ACTIVATED GADOLINIUM-SCANDIUM-GALLIUM GARNET CRYSTAL: A NEW LASER ACTIVE MEDIUM c36
Ye. V. Zarikov, V. V. Yaptev, V. G. Ostroumov, Yu. S. Privos, V. A. Smirnov, and I. A. Shcherbakov *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 61 refs Transl. into ENGLISH from Kvantovaya Elektronika (Moscow), v. 11, no. 8, Aug. 1984 p. 1565-1574 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

The mechanisms underlying the population of the upper lasing level of neodymium is investigated in order to identify the optimum working conditions for the active medium in various types of lasers. A general method is proposed for calculating the population of the excited state of acceptors interacting with energy donors which allows for non-radiative losses in the acceptor subsystem for the steady-state and pulsed pumping modes for any pumping pulse form. The time evolution of the population of the upper lasing level of 4F(3/2)Nu(3+) in gadolinium-scandium-gallium garnet crystals activated with chromium and neodymium is analyzed, along with the population gain in the 4F(3/2) level of Nd(3+) due to sensitization of Nd(3+) ion luminescence by Cr(3+) ions. The proposed method for calculating the kinetics of the decay of the excied state of acceptors interacting with energy donors is used to find the optimum concentrations of Nd(3+) ions in chromium- and neodymium- activated gadolinium-scandium-gallium garnet crystals for steady-state and impulse modes. Author

N86-11980# Joint Publications Research Service, Arlington, Va.
TWO-FREQUENCY PASSIVE MODE LOCKING IN IODINE PHOTODISSOCIATION LASER Abstract Only c36
V. M. Kiselev, A. S Grenishin, T. N. Kotlikova, and L. I. Rodina *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 61-62 p 61-62 refs Transl. into ENGLISH from Kvantovaya Elektron. (Moscow), v. 11, no. 8, Aug. 1984 p 1542-1554 Previously announced in IAA as A85-19246 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

Partially summed Maxwell-Bloch equations are used to estimate the ultimate potentialities of the passive mode-locking regime in an iodine laser under single-frequency and two-frequency lasing conditions. In the case of two-frequency passive mode locking an experimental discovery is made and an explanation is given of the appearance, in the laser emission spectrum, of the combination frequencies nu-sub 22 - Delta-nu and nu-sub 34 + Delta-nu, where Delta-nu is the spectral interval between nu-sub 22 and nu-sub 34. Author

N86-11981# Joint Publications Research Service, Arlington, Va.
EXPERIMENTAL INVESTIGATION OF RECORDING OF DYNAMIC HOLOGRAMS WITHIN ABSORPTION CONTOUR OF RESONANT ATOMIC MEDIUM Abstract Only c35
A. Ye. Korolev and D. I. Staselko *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 86 refs Transl. into ENGLISH from Opt. i Spektrosk. (Leningrad), v. 58, no. 1, Jan. 1985 p 147-152 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

The influence of the atomic concentration, the spectral width of the recording radiation and the resonance detuning on the diffraction efficiency of dynamic holograms recorded on the resonance lines of metals were studied. The efficiency of resonant dynamic holograms is investigated as function of the exposure for different vapor concentrations and resonance off-tuning. Good agreement is noted between the experimental and theoretical results. A region is identified in which the required tuning accuracy is determined by the spectral width of the recording radiation, which makes it possible to use a significantly wider group of radiation sources to record resonant dynamic holograms. E.A.K.

N86-11982# Joint Publications Research Service, Arlington, Va.
DIFFRACTION EFFICIENCY OF THREE-DIMENSIONAL PHASE HOLOGRAM OF DIFFUSE OBJECT Abstract Only c35
Yu. L. Korzinin and V. L. Sukhanov *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 87 refs Transl. into ENGLISH from Opt. i. Spektrosk. (Leningrad), v. 58, no. 1, Jan. 1985 p 142-146 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

The diffraction efficiency of the hologram of a diffuse object is analyzed within the framework of a space-frequency approach in which the diffraction efficiency is expressed through the spectrum of the wave recovered by the hologram. The diffraction efficiencies and the expsoures needed to achieve them are shown to be a function of the relationship between the intensities of the interfering beams, and the geometry of the hologram recording scheme. It is recommended that oblique incidence of the reference wave be employed in recording the hologram of the object. The angle of incidence of the object wave should consider that the hologram efficiency decreases as the angle becomes smaller, but that the exposure level needed to obtain maximum efficiency becomes somewhat longer. E.A.K.

N86-11983# Joint Publications Research Service, Arlington, Va.
POSSIBILITY OF OPTIMAL CHOICE OF EXPOSURE TIME FOR HOLOGRAPHIC RECORDING OF OBJECTS THROUGH UNSTEADY SCATTERING MEDIA Abstract Only c35
O. V. Angelskiy, V. V. Yatsenko, and D. I. Derkach *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 89 refs Transl. into ENGLISH from Zh. Prikl. Spektrosk. (Minsk, USSR), v. 42, no. 1, Jan. 1985 p 118-122 Original language doc. was announced as A85-28983 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

A study of the possibility of the holographic measurement of the velocity distributions of Brownian movement in scattering media has yielded an algorithm for optimum exposure selection during holographic recording through unsteady scattering media. It is shown that by varying the hologram exposure. It is possible to obtain information on subensembles of Brownian particles of various mobilities, i.e., on the velocity distribution of the particles. The algorithm proposed here is verified experimentally. V.L. (IAA)

N86-11984# Joint Publications Research Service, Arlington, Va.
GENERAL-PURPOSE EQUIPMENT FOR AIRBORNE LASER REMOTE SENSING OF OCEAN, ATMOSPHERE AND AGRICULTURAL CROPS Abstract Only c43
A. F. Bunkin, D. V. Vlasov, A. S. Glaumyan, D. V. Maltsev, D. M. Mirkamilov, and V. P. Slobodyanin *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 94 refs Transl. into ENGLISH from Zh. Tekhn. Fiz. (Leningrad), v. 54, no. 11, Nov. 1984 p 2190-2195 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

A general-purpose airborne laser remote sensing system is described for ocean and land research from altitudes of 800 to

1200 meters to obtain information on the thermodynamic parameters of the ocean, currents, ocean depth, and the condition and yield of agricultural crops. The system, which is carried aboard an AN-30 aircraft, employs fluorescent spectroscopy to determine small concentrations of organic impurities in sea water. The airborne system is described in detail; the results of measurements of bodies of water and land areas are discussed. The development of this system opens up fundamentally new capabilities for laser spectroscopy in environmental pollution montioring, and to map currents and turbulence in the ocean, and to diagnose crop yields. E.A.K.

N86-11985# Joint Publications Research Service, Arlington, Va.
PHOTOINDUCED RAYLEIGH SCATTERING OF LIGHT IN CRYSTALS Abstract Only **c74**
V. V. Obukhovskiy and A. V. Stoyanov *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 97 p 97 Transl. into ENGLISH from Opt. i Spektrosk. (Leningrad), v. 58, no. 2, Feb. 85 p 3780-385 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

The intensity of light scattered by inhomogeneities of the dielectric constant of ferroelectric crystals was calculated. It was shown that the scattering intensity is a sum of two terms: one due to scattering by inhomogeneities present initially and the other due to scattering by inhomogeneities which are induced by the exciting radiation. It was shown that the scattering process is nonstationary. Both components of the scattering intensity increase with time, but the second component of the scattering is absent initially and approaches a finite value at infinite time. The dynamic behavior of the scattering intensity was very sensitive to the statistical properties of the exciting radiation. For incoherent light the scattering intensity relaxes to a steady-state value within a time of the order of the dark relaxation time. In coherent light, however, a holographic pattern is formed as a result of the interference of the pump wave with the induced wave. The study of the dynamic behavior of the scattering intensity provides an independent means for determining the coefficients of photoconductivity and dark conductivity and the saturation optical inhomogeneity. E.A.K.

N86-11986# Joint Publications Research Service, Arlington, Va.
MULTIPHOTON RAMAN SCATTERING OF LIGHT EXCITED IN CRYSTALS BY A COPPER-VAPOR LASER Abstract Only **c74**
A. M. Agaltsov, V. S. Gorelik, and M. M. Sushchinskiy *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 98 p 98 refs Transl. into ENGLISH from Opt. i Spektrosk. (Leningrad), v. 58, no. 2, Feb. 85 p 386-389 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

Multiphoton Raman scattering was excited in lithium tantalate and potassium chloride crystals with a copper-vapor laser emitting at two wavelengths. The laser operated in a quasicontinuous mode: the pulse repetition frequency was equal to + or - 8 kHz. The pulse power and pulse duration were equal to 20 kW and 15 nsec, respectively. In lithium tantalate, the multiphoton Raman scattering was studied near the second optical harmonic under excitation with the laser radiation at lambda = 578.2 nm and in the region of the sum under excitation with laser radiation at both wavelengths. In potassium chloride, three-photon scattering was studied near the second optical harmonic. The scattered radiation was recorded in the continuous mode at 300 K with a spectral resolution of 10 to 50 cm. E.A.K.

N86-11987# Joint Publications Research Service, Arlington, Va.
PHASING OF MULTIPLE-APERTURE OPTICAL SYSTEMS Abstract Only **c74**
P. A. Bakut, A. D. Rayakin, K. N. Sviridov, and N. D. Ustinov *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 98 refs Transl. into ENGLISH from Opt. i Spektrosk. (Leningrad), v. 58, no. 2, Feb. 1985 p 445-448 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

Image sharpness functions were studied for the problem of phasing multiple aperture systems. Phasing is achieved by maximizing the image-sharpness function. From an examination of the optical transfer function of the system it was determined that a image-sharpness functions are acceptable in the absence of phase distortions of the wave front while type b functions are acceptable in the presence of phase distortions. E.A.K.

N86-11988# Joint Publications Research Service, Arlington, Va.
TRANSFORMATION OF LIGHT PULSE SHAPE BY THIN PLANE-PARALLEL LAYER OF ABSORBING MATERIAL Abstract Only **c74**
N. I. Insarova and G. I. Olefir *In its* USSR Rept.: Phys. and Math. (JPRS-UMP-85-005) 20 Aug. 1985 p 101 refs Transl. into ENGLISH from Zh. Prikl. Spektrosk. (Minsk, USSR), v. 42, no. 2, Feb. 1985 p 255-259 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

The properties of the reflection of radiation by a plane-parallel absorbing layer on the characteristics of a powerful light pulse reflected from or passing through the layer were investigated. Self-interaction is studied, in which the thermal nonlinearity of the index of refraction of the layer is caused by the incidence of the radiation on the layer at some angle alfa that is smaller than alfa sub 0 IC and it is found that the shape of the pulse that is reflected or passed through the layer can differ greatly from that of the incident pulse due to variation in the refractivity of the layer due to heating caused by the incident pulse. Layers that exhibit this property can be employed in quantum electronic devices as general-purpose high-sensitivity nonlinear elements. E.A.K.

N86-11989# Joint Publications Research Service, Arlington, Va.
HYDROTHERMODYNAMICS OF THE NEAR-SURFACE LAYER OF A LIQUID AND OPTICAL METHODS OF INVESTIGATING IT **c77**
O. D. Fedorovskyy *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 107-115 refs Transl. into ENGLISH from Visnyk Akad. Nauk Ukrayinskoyi RSR (Kiev), no. 11, Nov. 1984 p 15-21 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

Information on the temperature distribution at the air-water interface, which is obtained by contact and remote methods is described. It is pointed out, that methods do not consider the complex thermohydrodynamic structures which form in water layers near the surface, with dimensions of the order of millimeters. Diagnosis of the dynamic processes which take place in the ocean by remote sensing of the surface is emphasized. Results of the remote measurement of the spatial scale and the values of the temperature anomalies of a homogeneous are presented. It is concluded that there is a possibility of determining the dimensions and energy of the synoptic vortex and indications of the parameters of internal waves through characteristic thermal radiations of the free surface of the ocean in the infrared region of the spectrum. E.A.K.

N86-11990# Joint Publications Research Service, Arlington, Va.
USSR REPORT: SCIENCE AND TECHNOLOGY POLICY
25 Sep. 1985 105 p Transl. into ENGLISH from various Russian articles
(JPRS-UST-85-014) Avail: NTIS HC A06

Soviet policies applied to science and technology are reported. Topics discussed include: organization, planning and coordination, automation and information policy, and training and education. For individual titles, see N86-11991 through N86-11993.

N86-11991# Joint Publications Research Service, Arlington, Va.
BOOK ON PLANNING OF SCIENTIFIC, TECHNICAL PROGRESS **c81**
A. N. Andrukhovich, V. Yu. Budvey, T. N. Kalinovskaya, B. P. Krasnoglazov, V. M. Likhtenshteyn, L. I. Maksimov, V. L. Mershko, Ye. V. Sapilov, P. A. Sedlov, and T. L. Sletova *In its* USSR Rept.: Sci. and Technol. Policy (JPRS-UST-85-014) 25 Sep. 1985 p 11-14 Transl. into ENGLISH from Oshchestvennyye Nauki

v SSSR, Ser. 2: Ekonomika (Referativnvy Zh.) (Moscow), no. 1, Jan. - Feb. 1985 p 60-64 (For primary document see N86-11990 02-70)
Avail: NTIS HC A06

The general problems of planning scientific and technical progress were examined: the role of planning as the basic tool in the acceleration of scientific and technical development, and the structure of plans for new equipment and the basic directions of the improvement of planning are revealed. It is pointed out that the lack of precise criteria in the determination of the novelty of equipment, leads to the decrease of the rate and scale of the assimilation of advanced types of products. Author

N86-11992# Joint Publications Research Service, Arlington, Va.
COMPUTER-AIDED DESIGNING, ENGINEERING, PREPARATION OF PRODUCTION c61
Yu. I. Topcheyev *In its* USSR Rept.: Sci. and Technol. Policy (JPRS-UST-85-014) 25 Sep. 1985 p 20-24 Transl. into ENGLISH from Vest. Vysshey Shkoly (Moscow), no. 5, May 1985 p 29-31 (For primary document see N86-11990 02-70)
Avail: NTIS HC A06

The introduction of flexible manufacturing systems and robots in industry and agriculture and the complete automation of production, are impossible without the use of computer-aided design systems, engineering and the technological preparation of production (SAPR). The use of SAPR allows the combination of a single cycle and the performance of planning and design work and technological preparation. The production cycle improves the working conditions of designers and workers, frees them from routine operations and affords greater opportunities for creative activity. E.A.K.

N86-11993# Joint Publications Research Service, Arlington, Va.
PROBLEMS, TRENDS IN TECHNICAL EDUCATION OF RESEARCHERS c80
O. M. Belotserkovskiy *In its* USSR Rept.: Sci. and Technol. Policy (JPRS-UST-85-014) 25 Sep. 1985 p 52-62 Transl. into ENGLISH from Vest. Vyssey Shkoly (Moscow), no. 5, May 1985 p 25-29 (For primary document see N86-11990 02-70)
Avail: NTIS HC A06

The scientific and technical revolution has a profound influence on all levels and areas of general and specialized education, including higher education. The problems and trends in the development of modern higher technical education, which are most important in the training of research personnel in the physical-technical sciences are discussed. E.A.K.

N86-11994# Joint Publications Research Service, Arlington, Va.
CHINA REPORT: SCIENCE AND TECHNOLOGY
16 May 1985 134 p refs Transl. into ENGLISH from various Chinese articles
(JPRS-CST-85-015) Avail: NTIS HC A07/MF A01

Progress in science and technology in the People's Republic of China is reported. Topics discussed include: life sciences, environmental quality, acoustics, chemistry, communications, computer development and applications, electronics, lasers, mathematics, and mechanics. For individual titles, see N86-11995 through N86-12006.

N86-11995# Joint Publications Research Service, Arlington, Va.
HIGH-SPEED SIGNAL PROCESSOR DEVELOPED Abstract Only c60
In its China Rept.: Sci. and Technol. (JPRS-CST-85-015) 16 May 1985 p 10 Transl. into ENGLISH from Jisuanji Shijie (Beijing), no. 7, 8 Apr. 1984 p 7 (For primary document see N86-11994 02-70)
Avail: NTIS HC A07/MF A01

The Fast Fourier Transform signal processor, a special use computer used for high speed realtime signal processing was developed. The computer uses an Am2901 bit slice device, VLSI multiplier TDC 1010, and RAM2147H high speed components with FFT algorithms, automatic calibration, and microprogram control. Word length is 16-bits, the power spectrum time for 1024 real number points is 5ms, the highest sampling frequency of realtime processing is 200 KHz. With this computer as the core, the attached A/D converter and microcomputer can carry out pre and post processing. Existing functions are FFT, IFFT, automatic reciprocal power spectrum and automatic reciprocal switching. E.A.K.

N86-11996# Joint Publications Research Service, Arlington, Va.
NEW R AND D IN CHINESE LANGUAGE INFORMATION PROCESSING Abstract Only c82
In its China Rept.: Sci. and Technol. (JPRS-CST-85-015) 16 May 1985 p 11-12 Transl. into ENGLISH from Jisuanji Shijie (Beijing), no. 7, 8 Apr. 1984 p 7 (For primary document see N86-11994 02-70)
Avail: NTIS HC A07/MF A01

The Plug compatible type Chinese Character Terminal and the Plug compatible type Chinese Character Processing System was developed. The development of China's Chinese language information processing systems went through three stages: (1) simple Chinese written language processing systems with Chinese character management functions; (2) Chinese character high level language Chinese language computer systems compatible with Western languages; (3) Chinese language information processing systems with Chinese character support for high level language carried out by revising the original computer control system. The task of getting a Chinese language computer system has reached the stage where it can be used in a preliminary way. The operating systems of machines above the medium and large scale level are hard to change and the Chinese character processing function was a main computer. The search for a newer and faster way to resolve the problem of Chinese character processing which faces Chinese language information processing is discussed. E.A.K.

N86-11997# Joint Publications Research Service, Arlington, Va.
CENTER FOR HIGH TEMPERATURE PLASMA PHYSICS CERTIFIED Abstract Only c75
Hu Maolian *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-015) 16 May 1985 p 13-14 Transl. into ENGLISH from Anhui Ribao (Hefei), 21 Jan. 1985 p 1 (For primary document see N86-11994 02-70)
Avail: NTIS HC A07/MF A01

The construction and functions of a research center for high temperature plasma physics and controlled thermonuclear fusion are discussed. It has four of China's largest d.c. pulse generators capable of producing 80 megawatts of power, an induction coil capable of storing 200 million joules of electric energy, and a capacitor bank that can store 8 million joules of energy. It has equipment for producing deionized water, low temperature equipment, a cooling system using refrigerated circulating water, and a heat supply system. The center is one of China's important bases for thermonuclear fusion research. E.A.K.

N86-11998# Joint Publications Research Service, Arlington, Va.
CONTROLLED THERMONUCLEAR FUSION, HIGH TEMPERATURE PLASMA PHYSICS Abstract Only c75
In its China Rept.: Sci. and Technol. (JPRS-CST-85-015) 16 May 1985 p 15 Transl. into ENGLISH from Anhui Ribao (Hefei), 21 Jan. 1985 p 1 (For primary document see N86-11994 02-70)
Avail: NTIS HC A07/MF A01

The primary source of nuclear energy comes from the fission process of heavy nuclei. To utilize the energy released by a thermonuclear fusion process, methods of controlling the fusion reaction were studied. This is controlled thermonuclear fusion technology. The fuel used in a thermonuclear fusion process are isotopes of hydrogen: deuterium and tritium. They can be extracted from the almost unlimited seawater. Nuclear fusion also produces very little radioactive waste. Thermonuclear fusion is a promising energy source with an almost unlimited supply; it is economical, safe, and relatively clean. Ways to raise plasma temperature to a very high level and to maintain it to allow fusion reactions to take place are studied. The physical laws of high temperature plasma was studied to reach this goal which resulted in the development of high temperature plasma physics. E.A.K.

N86-11999# Joint Publications Research Service, Arlington, Va.
THIRD NATIONAL ACADEMIC MACHINE RETRIEVAL CONFERENCE HELD IN ZHENJIANG Abstract Only c82
In its China Rept.: Sci. and Technol. (JPRS-CST-85-015) 16 May 1985 p 26-27 Transl. into ENGLISH from Jisuanji Shijie (Beijing), no. 1, 8 Jan. 1984 p 1 (For primary document see N86-11994 02-70)
Avail: NTIS HC A07/MF A01

The set up and build up of data base of nearly a million documents was introduced. Improvements to the Toshinari Kikuchi algorithm which is an inquiry processing algorithm widely used in selective service programs was presented. The multi-user on line book title retrieval system introduced the implementation of a small book title retrieval system which uses a minicomputer with a minimum configuration. The on line processing system for Chinese language personnel files and document materials using Chinese character terminal was introduced. A library information automated data base is proposed. The viewpoint of fuzzy set mathematics in an information retrieval system, and a mathematical model of a fuzzy set retrieval language and its implementation are presented. E.A.K.

N86-12000# Joint Publications Research Service, Arlington, Va.
MICROCOMPUTER-CONTROLLED HIGH-ALTITUDE DATA ACQUISITION SYSTEM Abstract Only c89
In its China Rept.: Sci. and Technol. (JPRS-CST-85-015) 16 May 1985 p 36 Transl. into ENGLISH from Jisuanji Shijie (Beijing), no. 7, 8 Apr. 1984 p 8 (For primary document see N86-11994 02-70)
Avail: NTIS HC A07/MF A01

A new microcomputer controlled high altitude data acquisition system was developed. The system provides a new technique for data acquisition from China's astronomical, meteorological and other high altitude experiments and opens up new territory in microcomputer applications. This microcomputer controlled high altitude data acquisition system is made up of a Z80 single board computer, 10 K memory expansion board, and keyboard and display board which can collect 16 analog signals simultaneously, and through analog/digital conversion can convert external analog signals into digital signals then encode them in a certain form through program modulation and store them on audio cassette. The data is immediately retrieved from the tape and sent to the surface microcomputer system for data processing and analysis. E.A.K.

N86-12001# Joint Publications Research Service, Arlington, Va.
COMPUTER APPLICATION IN ATOMIC ABSORPTION SPECTROMETRY c72
Hu Xinyao and Zhang Liangping *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-015) 16 May 1985 p 51-57 refs Transl. into ENGLISH from Fenxi Huaxue (Changchun), no. 6, 20 Jun. 1983 p 451-454 (For primary document see N86-11994 02-70)
Avail: NTIS HC A07/MF A01

In the past the presence of sulfates interfered with the measurement of calcium and magnesium by chemical separation method or the spectrometric method of changing the spectrum condition. A mathematical model was designed by using the method of computer atomic absorption spectrometry to determine and calculate the concentrations of calcium and magnesium and the concentration of the interfering sulfate radicals. The computer processing method and the mathematical model used to measure other elements under similar conditions is discussed. E.A.K.

N86-12002# Joint Publications Research Service, Arlington, Va.
A GENERAL PURPOSE CAD PROGRAM FOR MICROWAVE LINEAR CIRCUITS c33
Yenyang Shih *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-015) 16 May 1985 p 93 refs Transl. into ENGLISH from Tongxin Xuebao (Beijing), no. 2, Apr. 1984 p 60-65 (For primary document see N86-11994 02-70)
Avail: NTIS HC A07/MF A01

A general purpose computer aided design program for microwave linear circuits is presented. This program has the capability to perform frequency domain analysis, optimization, sensitivity analysis, and Monte Carlo analysis for passive or active circuits with complex topology, including lumped and/or distributed elements. Four sections are presented: (1) a mathematical description of the methodology used; (2) a flow diagram showing the logical structure of the program; (3) a summary of the types of microwave circuits that can be analyzed by the program; and; (4) numerical examples of analysis and optimization results for selected circuits of different topology. It is shown that the numerical results obtained from the program MICAD are consistent with those obtained from the program COMPACT. E.A.K.

N86-12003# Joint Publications Research Service, Arlington, Va.
DOUBLE-WAVELENGTH PULSED TUNABLE DYE LASER Abstract Only c36
Zaixuan Zhang, Jingyun Wang, Yiqian Yuan et al *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-015) 16 May 1985 p 97 Transl. into ENGLISH from Zhongguo Jiguang (Shanghai), v. 11, no. 6, 20 Jun. 1984 p 323-326 (For primary document see N86-11994 02-70)
Avail: NTIS HC A07/MF A01

Simultaneous tunable two wavelength operation of the tunable dye laser pumped by SHG of a Nd:YAG pulsed repetitive Q switched laser is described. The R6G, R6G+R640 and R6G+LD473 mixtures in methanol solution were studied. The proper choice of the beam splitter and the Brewster prism pre-expander grazing incident grating cavity provided a wide tunable spectral range and low background ASE. The polarized peak output power of the laser is about 40 kW and the spectral bandwidth is 0.22 cm/1. E.A.K.

N86-12004# Joint Publications Research Service, Arlington, Va.
INVOLUTORY TRANSFORMATIONS AND VARIATION PRINCIPLES WITH MULTIVARIABLES IN THIN PLATE BENDING PROBLEMS Abstract Only c39
Weichang Qian *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-015) 16 May 1985 p 107 Transl. into ENGLISH from Yingyong Shuxue he Lixue (Chongquing), v. 6, no. 1, Jan. 1985 p 25-40 (For primary document see N86-11994 02-70)
Avail: NTIS HC A07/MF A01

The generalized variational principles of plate bending problems are established from their minimum potential energy principle and minimum complementary energy principle through the elimination of their constraints by the Lagrange multipliers method. The involutory transformations are also introduced to reduce the order of differentiations for the variables in the variation. The involutory transformations become the additional constraints in the variation, and additional Lagrange multipliers may be used to remove these additional constraints. Various multivariable variational principles are obtained for the plate bending problems. It is observed that not all the constraints of variation can be removed simply by the ordinary method of linear Lagrange multipliers. In such cases, the method of high order Lagrange multipliers are used to remove those constraints left over by ordinary linear multiplier method. Functionals of more general forms are obtained for the generalized variational principles of plate bending problems. E.A.K.

N86-12005# Joint Publications Research Service, Arlington, Va.
NUMERICAL METHOD IN DYNAMIC RESPONSE OF NONLINEAR SYSTEMS Abstract Only c39
Zhaochang Zheng and Mingyi Tan *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-015) 16 May 1985 p 108 Transl. into ENGLISH from Yingyong Shuxue he Lixue (Chongquing), v. 6, no. 1, Jan. 1985 p 93-101 (For primary document see N86-11994 02-70)
Avail: NTIS HC A07/MF A01

A modal synthesis technique which is applicable to vibration analysis for linear substructures with nonlinear coupling attachments is extended to nonlinear dynamic analysis. A process is suggested which modal synthesis techniques are further extended to dynamic analysis of large complex structural systems with nonlinear characteristics of each substructure. The high efficiency of this process is shown. E.A.K.

N86-12006# Joint Publications Research Service, Arlington, Va.
ON CONVECTIVE EFFECTS IN GAS LASERS Abstract Only
c36
Zhi Gao *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-015) 16 May 1985 p 116 Transl. into ENGLISH from Wuli Xuebao (Beijing), v. 33, no. 9, Sep. 1984 p 1294-1300 (For primary document see N86-11994 02-70)
Avail: NTIS HC A07/MF A01

The convection of the gain medium is a decisive factor for large increase in power output of gas lasers. It is shown that both the saturation intensity and the laser power density by which the CW laser is characterized increase nonlinearly with the flow speed and tend toward the respective limiting values. It is also shown that the increment of the saturation intensity does not go beyond 10 times, and a large increase in power density is caused by the accumulation of excited energy in the flowing gas. The quantitative results of the variation of the saturation intensity with the gas flow transient time are consistent with the experimental data of the flowing CO2 gas lasers, where the gas flow transient time denotes the time required for the flowing gas to move across the gas gain region or the probing beam section. E.A.K.

71 ACOUSTICS

Includes sound generation, transmission and attenuation. For noise pollution see *45 Environment Pollution.*

N86-12007*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NUMERICAL TECHNIQUES IN ACOUSTICS
Kenneth J. Baumeister, comp. Oct. 1985 35 p refs Meeting held in Miami Beach, Fla., 17-21 Nov. 1985; sponsored by the ASME
(NASA-CP-2404; E-2758; NAS 1.55:2404) Avail: NTIS HC A03/MF A01 CSCL 20A

This is the compilation of abstracts of the Numerical Techniques in Acoustics Forum held at the ASME's Winter Annual Meeting. This forum was for informal presentation and information exchange of ongoing acoustic work in finite elements, finite difference, boundary elements and other numerical approaches. As part of this forum, it was intended to allow the participants time to raise questions on unresolved problems and to generate discussions on possible approaches and methods of solution. For individual titles, see N86-12008 through N86-12016.

N86-12008*# Alberta Univ., Edmonton.
APPLICATION OF HIGH ORDER ACOUSTIC FINITE ELEMENTS TO TRANSMISSION LOSSES AND ENCLOSURE PROBLEMS Abstract Only
A. Craggs and G. Stevenson *In* NASA. Lewis Research Center Numerical Tech. in Acoustics Oct. 1985 p 1-2 ref (For primary document see N86-12007 02-71)
Avail: NTIS HC A03/MF A01 CSCL 20A

A family of acoustic finite elements was developed based on C continuity (acoustic pressure being the nodal variable) and the no-flow condition. The family include triangular, quadrilateral and hexahedral isoparametric elements with linear quadratic and cubic variation in modelling and distortion. Of greatest use in problems with irregular boundaries are the cubic isoparametric elements: the 32 node hexahedral element for three-dimensional systems; and the twelve node quadrilateral and ten node triangular elements for two-dimensional/axisymmetric applications. These elements were applied to problems involving cavity resonances, transmission loss in silencers and the study of end effects, using a Floating Point Systems 164 attached array processor accessed through an Amdahl 5860 mainframe. The elements are presently being used to study the end effects associated with duct terminations within finite enclosures. The transmission losses with various silencers and sidebranches in ducts is also being studied using the same elements. Author

N86-12009*# Naval Ship Research and Development Center, Bethesda, Md.
ON THE COMPUTATION OF STRUCTURAL VIBRATIONS INDUCED BY A LOW-SPEED TURBULENT FLOW Abstract Only
c39
Y. F. Hwang *In* NASA. Lewis Research Center Numerical Tech. in Acoustics Oct. 1985 p 3-5 (For primary document see N86-12007 02-71)
Avail: NTIS HC A03/MF A01 CSCL 20K

A method for numerical evaluation of the vibrations of a cylindrical shell structure induced by a low speed external turbulent flow is discussed. The direction of flow is along the axis of revolution of the shell, and the source of excitation is the pressure fluctuations in the turbulent boundary layer. For the investigation of vibration and noise problems it is usually more desirable to utilize the modal expansion approach. The axisymmetric shell structure can be modeled by the assemblage of conical-shell finite-elements. This modeling allows the eigenfunction psi sub mn (x,theta) to be represented in a rectangular product of a longitudinal modal function f sub mn (x) and a circular harmonic function cos m theta (or sin m theta). Author

N86-12010*# Houston Univ., Tex.
IMPROVING THE ACCURACY OF THE BOUNDARY INTEGRAL METHOD BASED ON THE HELMHOLTZ INTEGRAL Abstract Only
c39
G. H. Koopmann and K. Brod *In* NASA. Lewis Research Center Numerical Tech. in Acoustics Oct. 1985 p 7-8 (For primary document see N86-12007 02-71)
Avail: NTIS HC A03/MF A01 CSCL 20K

Several recent papers in the literature have been based on various forms of the Helmholtz integral to compute the radiation fields of vibrating bodies. The surface integral form is given. The symbols of P,R micron, rho,G,R,V, and S micron are acoustic pressure, source coordinate, angular frequency, fluid density, Green function, field coordinate, surface velocity and body surface respectively. A discretized form of the surface integral is also given. Solutions to the surface integral are complicated with the singularity of the Green function at R=R micron and with the uniqueness problem at interior eigen frequencies of the enclosed space. The use of the interior integral circumvents the singularity problem since the field points are chosen in the interior space of the vibrating body where a zero pressure condition exists. The interior integral form is given. The method to improve the accuracy is detailed. Examples of the method is presented for a variety of radiators. Author

N86-12011*# Texas A&M Univ., College Station. Dept. of Aerospace Engineering.
A NUMERICAL METHOD OF CALCULATING PROPELLER NOISE INCLUDING ACOUSTIC NONLINEAR EFFECTS Abstract Only
K. D. Korkan *In* NASA. Lewis Research Center Numerical Tech. in Acoustics Oct. 1985 p 9-10 refs (For primary document see N86-12007 02-71)
(Grant NAG3-354)
Avail: NTIS HC A03/MF A01 CSCL 20A

Using the transonic flow fields(s) generated by the NASPROP-E computer code for an eight blade SR3-series propeller, a theoretical method is investigated to calculate the total noise values and frequency content in the acoustic near and far field without using the Ffowcs Williams - Hawkings equation. The flow field is numerically generated using an implicit three dimensional Euler equation solver in weak conservation law form. Numerical damping is required by the differencing method for stability in three dimensions, and the influence of the damping on the calculated acoustic values is investigated. The acoustic near field is solved by integrating with respect to time the pressure oscillations induced at a stationary observer location. The acoustic far field is calculated from the near field primitive variables as generated by NASPROP-E computer code using a method involving a perturbation velocity potential as suggested by Hawkings in the calculation of the acoustic pressure time-history at a specified far field observed

location. the methodologies described are valid for calculating total noise levels and are applicable to any propeller geometry for which a flow field solution is available. Author

N86-12012*# National Aeronautics and Space Administration. National Space Technology Labs., Bay Saint Louis, Miss.
A GENERAL-APPLICATIONS DIRECT GLOBAL MATRIX ALGORITHM FOR RAPID SEISMO-ACOUSTIC WAVEFIELD COMPUTATIONS
Henrik Schmidt (SACLANT ASW Research Center), Gerard J. Tango, and Michael F. Werby *In* NASA. Lewis Research Center Numerical Tech. in Acoustics Oct. 1985 p 11-15 refs (For primary document see N86-12007 02-71)
Avail: NTIS HC A03/MF A01 CSCL 20A

A new matrix method for rapid wave propagation modeling in generalized stratified media, which has recently been applied to numerical simulations in diverse areas of underwater acoustics, solid earth seismology, and nondestructive ultrasonic scattering is explained and illustrated. A portion of recent efforts jointly undertaken at NATOSACLANT and NORDA Numerical Modeling groups in developing, implementing, and testing a new fast general-applications wave propagation algorithm, SAFARI, formulated at SACLANT is summarized. The present general-applications SAFARI program uses a Direct Global Matrix Approach to multilayer Green's function calculation. A rapid and unconditionally stable solution is readily obtained via simple Gaussian ellimination on the resulting sparsely banded block system, precisely analogous to that arising in the Finite Element Method. The resulting gains in accuracy and computational speed allow consideration of much larger multilayered air/ocean/Earth/engineering material media models, for many more source-receiver configurations than previously possible. The validity and versatility of the SAFARI-DGM method is demonstrated by reviewing three practical examples of engineering interest, drawn from ocean acoustics, engineering seismology and ultrasonic scattering. Author

N86-12013*# National Aeronautics and Space Administration. National Space Technology Labs., Bay Saint Louis, Miss.
NUMERICAL TECHNIQUES FOR SCATTERING FROM SUBMERGED OBJECTS Abstract Only
Michael F. Werby, Gerald J. Tango, and G. C. Gaunaurd (Naval Surface Weapons Center, White Oak, Md.) *In* NASA. Lewis Research Center Numerical Tech. in Acoustics Oct. 1985 p 17-20 refs (For primary document see N86-12007 02-71)
Avail: NTIS HC A03/MF A01 CSCL 20A

To represent the final results in terms of matrices, one expands all appropriate physical quantities in terms of partial wave basis states. This includes expansions for the incident and scattered fields and the surface quantities. The method then utilizes the Huygen-Poincare integral representation for both the exterior and interior solutions, leading to the required matrix equations. One thus deals with matrix equations, the complexity of which depends on the nature of the problem. It is shown that in general a transition matrix T can be obtained relating the incident field A with the scattered field f having the form T = PQ(-1), where f = TA. The structure of Q can be quite complicated and can itself be composed of other matrix inversions such as arise from layered objects. Recent improvements in this method appropriate for a variety of physical problems are focused on, and on their implementation. Results are outlined from scattering simulations for very elongated submerged objects and resonance scattering from elastic solids and shells. The final improvement concerns eigenfunction expansions of surface terms, arising from solution of the interior problem, obtained via a preconditioning technique. This effectively reduces the problem to that of obtaining eigenvalues of a Hermitian operator. This formalism is reviewed for scattering from targets that are rigid, sound-soft, acoustic, elastic solids, elastic shells, and elastic layered objects. Two sets of the more interesting results are presented. The first concerns scattering from elongated objects, and the second to thin elastic spheroids. Author

N86-12014*# Purdue Univ., Lafayette, Ind.
PREDICTION OF ACOUSTICAL RESPONSE OF THREE-DIMENSIONAL CAVITIES USING AN INDIRECT BOUNDARY ELEMENT METHOD Abstract Only
Robert J. Bernhard and Carl R. Kipp (Bell Labs., Whippany, N.J.) *In* NASA. Lewis Research Center Numerical Tech. in Acoustics Oct. 1985 p 21-23 ref (For primary document see N86-12007 02-71)
Avail: NTIS HC A03/MF A01 CSCL 20A

A technique which characterizes the acoustics of generalized cavities with the minimum model possible is developed. All boundary element methods have two advantages over finite element methods: (1) the models are smaller; and (2) the assumed variable behavior, inherent in the method to allow discretization, is harmonic rather than polynomial. Further, IBEM often requires one rather than two numerical boundary integrals as required by DBEM. Thus, a quadratic, isoparametric IBEM program was developed. The source distribution in this solution is continuous and quadratically variable rather than continuous and constant. The program was also formulated to include the additional capability of interior point sources and impedance boundary conditions. To test the quadratic, isoparametric IBEM program, several simple cavity enclosure problems where studied. Results are shown. Author

N86-12015*# George Washington Univ., Hampton, Va.
VORTEX STUDIES RELATING TO BOUNDARY LAYER TURBULENCE AND NOISE Abstract Only
J. L. Adelman (George Washington Univ., Hampton, Va.) and J. C. Hardin *In* NASA. Lewis Research Center Numerical Tech. in Acoustics Oct. 1985 p 25-28 Previously announced as N85-27169 (For primary document see N86-12007 02-71)
Avail: NTIS HC A03/MF A01 CSCL 20A

The present study considers the two-dimensional case of an array of N rectilinear, like-sign vortices above an infinite flat boundary. The method of images can be employed with this configuration to reduce the problem to that of 2N vortices in free space, constrained by 2N symmetry relations. This system is Hamiltonian and therefore certain invariants of the motion are known. Further, from the Hamiltonian constant, the equations of motion are readily derived and may be integrated numerically to determine the vortex trajectories. This knowledge of the time-dependent vortex motion then allows the resulting noise radiation to be computed by standard aeroacoustic techniques. R.J.F.

N86-12016*# Iowa State Univ. of Science and Technology, Ames.
STATISTICAL SIGNAL ANALYSIS FOR SYSTEMS WITH INTERFERENCED INPUTS
Robin M. Bai and Anna L. Mielnicka-Pate *In* NASA. Lewis Research Center Numerical Tech. in Acoustics Oct. 1985 p 29-32 ref (For primary document see N86-12007 02-71)
Avail: NTIS HC A03/MF A01 CSCL 20A

A new approach is introduced, based on statistical signal analysis, which overcomes the error due to input signal interference. The model analyzed is given. The input signals u sub 1 (t) and u sub 2 (t) are assumed to be unknown. The measurable signals x sub 1 (t) and x sub 2 (t) are interferened according to the frequency response functions, H sub 12 (f) and H sub 21 (f). The goal of the analysis was to evaluate the power output due to each input, u sub 1 (t) and u sub 2 (t), for the case where both are applied to the same time. In addition, all frequency response functions are calculated. The interferenced system is described by a set of five equations with six unknown functions. An IBM XT Personal Computer, which was interfaced with the FFT, was used to solve the set of equations. The software was tested on an electrical two-input, one-output system. The results were excellent. The research presented includes the analysis of the acoustic radiation from a rectangular plate with two force inputs and the sound pressure as an output signal. Author

N86-12017# Defence Materiel Administration, Stockholm (Sweden). Radio Dept.
INFRASOUND: A SUMMARY OF INTERESTING ARTICLES
May 1985 271 p refs
(FMV:ELEKTRO-A12:142/83) Avail: NTIS HC A12/MF A01

A comprehensive accounting of infrasound levels under normal working conditions and in home environment, both in Sweden and in the rest of the world is discussed. Due to the fact that the results from different reports are not uniform and often incomplete, a direct comparison of results is not possible. The existence of high levels of man made low frequency noise (0 to 100 Hz), and in particular infrasonic noise, has been reported in many environments. An effort has been made over the last decade to discover whether such high levels of low frequency noise are significant. A review of the effects of low frequency noise indicates that the effects are similar to those of higher frequency noise, that noise in the 20 to 100 Hz range is much more significant than infrasound at similar sound pressure levels and that the possible danger due to infrasound has been much over rated. Author

N86-12018# Middleton (David), New York.
INTERMEDIATE AND HIGH-FREQUENCY ACOUSTIC BACKSCATTERING CROSS SECTIONS FOR WATER-ICE INTERFACES. 1: TWO-COMPONENT PROFILE MODELS Technical Report, Aug. 1983 - 30 Nov. 1984
D. Middleton 7 Mar. 1985 80 p
(Contracts N00140-83-M-PL78; N00140-84-M-MS42)
(AD-A157533; NUSC-TD-7375) Avail: NTIS HC A05/MF A01 CSCL 20/1

Two general statistical-physical models (1, 2) for underice surface elevations are constructed. These provide the basis for determining the intensities and associated frequency spectra of acoustic waves scattered from such water-ice interfaces. Both models embody two-component processes: the simpler model represents the interface as an appropriately weighted sum of two gaussian distributions of elevation, each with different nonzero means and variances. No explicit identification of keel structure is made. The second model does account for keel structure and assigns the Gaussian components of the first model respectively to two distinct physical processes: that of local iced generation and that of the intermittent, large-scale keel formation. In this report the analysis is limited to Model 1 and calculations of backscattering cross sections appropriate to intermediate and high frequencies i.e., Kirchoff-based methods. The treatment here is also restricted, for the moment, to zero gradient and single ice bottom surface interactions. In most instances, the Rayleigh numbers for both components of the underice surface are large, so that theories based solely on perturbation techniques and/or Bragg scatter are inadequate. GRA

N86-11169# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. for Experimental Fluid Mechanics.
AEROACOUSTIC WIND TUNNEL MEASUREMENTS ON PROPELLER NOISE
F.-R. Grosche and H. Stiewitt *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 9 p refs (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

N86-11171# Pratt and Whitney Aircraft of Canada Ltd., Longueuil (Quebec).
AN INVESTIGATION OF IN-FLIGHT NEAR-FIELD PROPELLER NOISE GENERATION AND TRANSMISSION
H. Bonneau, D. F. Wilford, and L. K. Wood *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 12 p refs (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

N86-11172# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Entwurfsaerodynamik.
FULL-SCALE FLIGHT AND MODEL-SCALE WIND TUNNEL TESTS ON THE NEARFIELD NOISE CHARACTERISTICS OF AIRCRAFT PROPELLERS
H. Heller, M. Kallergis, and B. Gehlhar *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 17 p refs (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

N86-11173# Aeritalia S.p.A., Pomigliano D'Arco (Italy).
CABIN NOISE REDUCTION FOR A NEW DEVELOPMENT TURBOPROP COMMUTER AIRCRAFT
A. Carbone, A. Paonessa, L. Lecce (Ist. Progetto Velivoli, Naples), and F. Marulo (Ist. Progetto Velivoli, Naples) *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 14 p refs (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

N86-11174# Lockheed-California Co., Burbank.
PROPELLER AIRCRAFT CABIN VIBRATION AND NOISE-EXCITATION, SOURCES, AND PATHS
R. E. Donham, F. J. Balena, E. Z. Bochary, and O. K. Liehr *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 14 p refs (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

N86-11175# Hamilton Standard, Windsor Locks, Conn.
THE STATE OF THE ART IN PROPFAN TURBOPROP NOISE
Frederick B. Metzger *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 20 p refs (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

N86-11176# Lockheed-Georgia Co., Marietta.
APPLICATION OF ACTIVE NOISE CONTROL TO MODEL PROPELLER NOISE
M. Salikuddin, H. K. Tanna, R. H. Burrin, and W. E. Carter *In* AGARD Aerodyn. and Acoustics of Propellers Feb. 1985 15 p refs (For primary document see N86-11147 02-01)
Avail: NTIS HC A20/MF A01

N86-11869# California Univ., Livermore. Lawrence Livermore Lab. Nuclear Test Engineering Div.
ANALYSIS OF ULTRASONIC WAVES IN A BOUNDED MEDIUM Abstract Only
Thomas A. Nelson and Gerald L. Goudreau *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 21 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

N86-11881# California Univ., Livermore. Lawrence Livermore Lab. Nuclear Energy Systems Div.
RAMP RESPONSE ESTIMATION AND SPECTRUM EXTRAPOLATION FOR ULTRASONIC SCATTERING Abstract Only
Gregory A. Clark *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 55 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

N86-11946# Joint Publications Research Service, Arlington, Va.
DIFFRACTION OF ULTRASONIC BEAM PASSING NORMALLY THROUGH LAYERED MEDIA Abstract Only
V. S. Konenenko *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 1 refs Transl. into ENGLISH from Fiz. (Tomsk), v. 28, no. 1, Jan. 1985 p 118-119 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

N86-11947# Joint Publications Research Service, Arlington, Va.
SPEED OF SOUND IN LIQUID SODIUM NEAR GAMMA-TRANSITION POINT Abstract Only
D. L. Timrot, M. A. Serednitskaya, and T. D. Chkhikvadze *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 1-2 refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 279, no. 3, Nov. 1984 p 617-621 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

N86-11948# Joint Publications Research Service, Arlington, Va.
RAMAN SCATTERING OF SOUND ON RANDOM OSCILLATIONS OF BUBBLES Abstract Only

Ye. A. Zabolotskaya *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 2 ref Transl. into ENGLISH from Kratk. Soobshch. po Fiz. (Moscow), no. 10, 1984 p 23-25 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

N86-11949# Joint Publications Research Service, Arlington, Va.
DETERMINATION OF PARAMETERS OF ELASTIC SPHERICAL SHELL FROM SCATTERED WAVE FIELD Abstract Only
A. V. Sergeyev *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 2-3 refs Transl. into ENGLISH from Akust. Zh. (Moscow), v. 31, no. 1, Jan.-Feb. 1985 p 96-102 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

N86-11950# Joint Publications Research Service, Arlington, Va.
STABILITY OF A METHOD FOR ANALYZING RADIATION PATTERN OF ACOUSTIC RADIATOR WITH NEAR-FIELD PRESSURE MEASUREMENT ERRORS Abstract Only
I. Ye. Tsukernikov *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 3 refs Transl. into ENGLISH from Akust. Zh. (Moscow), v. 31, no. 1, Jan.-Feb. 1985 p 111-113 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

N86-11951# Joint Publications Research Service, Arlington, Va.
REFLECTION OF SOUND FROM PLATE CONTAINING PERIODIC INHOMOGENEITIES Abstract Only
A. D. Lapin *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 5-6 refs Transl. into ENGLISH from Akust. Zh. (Moscow), v. 31, no. 1, Jan-Feb. 1985 p 73-76 Previously announced in IAA as A85-41647 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N86-12019*# Rice Univ., Houston, Tex.
LABORATORY STUDIES OF ATOMIC COLLISION PROCESSES OF IMPORTANCE IN PLANETARY ATMOSPHERES Annual Status Report
R. F. Stebbings and Ken Smith [Aug. 1985] 25 p
(Grant NsG7-386)
(NASA-CR-176301; NAS 1.26:176301) Avail: NTIS HC A02/MF A01 CSCL 20H

A series of differential cross sections for angular scattering and charge transfer was measured. These studies employ position-sensitive detectors (PSD's) to collect collision products scattered over a wide range of angles; and the research program includes investigation of differential cross sections for total angular scattering, charge transfer, stripping, and other collisions. All of these processes can be studied with the same basic apparatus, but minor modifications in the equipment details and in the data acquisition programs and techniques are required for each individual experiment. G.L.C.

N86-12020# Pittsburgh Univ., Johnstown, Pa.
FLOW REACTOR STUDIES OVER WIDE TEMPERATURE AND PRESSURE RANGES OF ATOM AND RADICAL REACTION RATES IMPORTANT IN IGNITION AND COMBUSTION Final Report, 16 Feb. 1981 - 15 Feb. 1985
F. Kaufman May 1985 9 p
(Contract DAAG29-81-K-0050)
(AD-A156931; ARO-17967.6-CH) Avail: NTIS HC A02/MF A01 CSCL 07/4

The completed research consists of critical evaluations of atom and radical reactions in terms of rate theory, the measurement of elementary reaction rate parameters for several important reactions, and the building and use of a new flow system for the study of H + O2 + M yields HO2 + M recombination. The experimental studies include the establishment of the primary products of the O + C2H4 reaction, viz. C2H3O + H in approximately 80% yield; the measurement of five H-atom abstraction reactions of OH with C2H6 and four Cl-and F-substituted ethanes; the proof, by use of 18O, that the fast reaction O + HO2 yields OH + O2 proceeds via an intermediate HO3 asterisk adduct; and the first direct measurement, by laser-induced fluorescence, of the CH3O + NO2 reaction rate over the temperature range 250 to 473 K. The 18O + NO, O2 isotope exchange reaction rates were measured and compared with theory, and a new, higher pressure flow reactor apparatus was built and the rate constants for H + O2 + M measured at 298K for M = He, N2, CH4, and H2O. GRA

N86-12021# San Diego State Univ., Calif. Dept. of Chemistry.
THE CHEMICAL PRODUCTION OF EXCITED STATE MOLECULES Final Report, 1 Jul. 1980 - 31 Mar. 1985
W. H. Richardson 31 Mar. 1985 12 p
(Contract DAAG29-80-K-0021)
(AD-A157276; ARO-17283.8-CH) Avail: NTIS HC A02/MF A01 CSCL 07/3

Most of the research deals with the effect of electronic structural variation upon the efficiency of triplet state carbonyl production from dioxetanes. Other studies involving dioxethanes include the question of preferential n, pi* state (vs pi, pi*) carbonyl formation and attempts to trap the proposed 1,4-dioxybiradical intermediate form thermolysis of dioxetanes. Some amino peroxides were also studied as potential sources of chemilumuniscence (CL). Finally, a detailed kinetic study was made on the thermolysis of a five-membered ring peroxide in order to distinguish between concerted vs stepwise decomposition routes. This study was pertinent to the mechanism of dioxetane (a four-ring peroxide) thermolysis. GRA

N86-12022# RAND Corp., Santa Monica, Calif.
SOVIET RESEARCH ON CRYSTAL CHANNELING OF CHARGED PARTICLE BEAMS Interim Report
S. Kassel Mar. 1985 57 p
(Contract MDA903-82-C-0067)
(AD-A157353; RAND/R-3224-ARPA) Avail: NTIS HC A04/MF A01 CSCL 20/7

This report presents an overview of Soviet research in charged particle beam channeling in crystals from 1972 to the present, and the resulting electromagnetic emission, including Soviet proposals for channeling emission lasers in the X-ray region of the spectrum. It analyzes Soviet attitudes toward crystal channeling of charged particles as a subject of research, describes performers of the research, and indicates the level of effort involved. It presents a brief history of crystal channeling research, the differences between channeling and other kinds of electromagnetic radiation, the definition of the main research issues, and estimates of the potential capabilities of channeling radiation, all based on the Soviet viewpoint. It then describes Soviet proposals for laser systems utilizing the channeling radiation mechanism, and analyzes Soviet experimental work involving the observation and measurement of channeling radiation. The author concludes that the outstanding feature of Soviet research in this area is the optimistic belief of Soviet specialists in the technological potential of this research, but finds that the role of the laser proposals in Soviet planning is ambiguous. Author (GRA)

N86-12023# Polytechnic Inst. of New York, Farmingdale.
PART A. MOLECULAR DYNAMICS AND IONIC ASSOCIATIONS OF LiAsF6 IN 4-BUTYROLACTONE MIXTURES WITH 2-METHYL TETRAHYDROFURAN. PART B. MOLECULAR DYNAMICS AND IONIC ASSOCIATIONS OF LiBF4 IN 1,2-DIMETHOXYMETHANE Technical Report, 1 Jan. - 30 Jun. 1985
Y. Harada, M. Salomon, S. Petrucci, M. Delsignore, and H. Farber 30 Jun. 1985 53 p
(Contract DAAG29-85-K-0048)
(AD-A157401; TR-7-Pt-A/B; ARO-21758.1-CH-Pt-A/B) Avail: NTIS HC A04/MF A01 CSCL 07/4

Solutions of LiAsF6 at 298.2 K were studied by audiofrequency conductance in the concentrations range .0001-.01 Mol/Cu

dm and by radiofrequency ultrasonic absorption in the concentration range 0.05 - 0.5 mol/cu dm. The solvents employed were mixtures of 4-butyrolactone with 2-methyl tetrahydrofuran varying in compositions from mole fractions X subscript BL = 0.10 X subscript BL = 0.75. In dilute solutions the audiofrequency conductivity data yield ion association constants which appear to represent both contact and solvent-separated ion pairs for mixtures up to X subscript BL = 0.36. At higher LiAsF6 concentrations and in solvent mixtures of composition X subscript BL = 0.75, and X subscript BL = 0.35, the ultrasonic spectrum shows a single relaxation process which again is attributed to the formation of both contact and solvent separated ion pairs. Part B: Electrical conductance data for LiBF4 in 1,2-Dimethyoxymethane (DMM)at 25 C reveal the electrolyte to be heavily associated to ion-pairs and triple ions. A theoretical expression for the triple ion association constant similar to the Bjerrum one for ion-pairs and to the Maaser-Bjerrum theory of dimers has been developed and applied to the present conductance data. Ultrasonic relaxation absorption data at much higher concentrations than the conductance data reveal association to dimers. This is also evident from the microwave dielectric data showing no electrolyte dielectric effect on the solvent and apparent lack of presence of dipoles. The ultrasonic data can be rationalized by a two-step dimerization mechanism. GRA

N86-12024# Aerospace Corp., El Segundo, Calif. Chemistry and Physics Lab.
THE USE OF WALL-COATED CELLS IN ATOMIC FREQUENCY STANDARDS
R. P. Frueholz, C. H. Volk, and J. C. Camparo 24 Jun. 1985 25 p Sponsored by Air Force
(AD-A157435; TR-0084A(5945-05)-5; SD-TR-85-18) Avail: NTIS HC A02/MF A01 CSCL 14/2

An analysis of the effect of the microwave field distribution on the application of a wall-coated, bufferless absorption cell in an atomic frequency standard has been performed. While certain advantages of using such a cell in an atomic frequency standard employing a TE sub 011 microwave cavity have been previously demonstrated, we show that a simple incorporation of this type of cell in a frequency standard using a TE sub 111 microwave cavity would not be advantageous. The role of the microwave field distribution, particularly its phase variation within the cavity, is analyzed, and suggestions concerning the use of a wall-coated cell in a TE sub 111 microwave cavity as applied to an atomic frequency standard are made. GRA

N86-12025# Naval Postgraduate School, Monterey, Calif.
EMISSION THRESHOLD FOR CERENKOV RADIATION
J. R. Neighbours, F. R. Buskirk, and X. K. Maruyama Jul. 1985 28 p
(AD-A157615; NPS61-85-005) Avail: NTIS HC A03/MF A01 CSCL 20/8

As a consequence of the phasing condition between the moving charge and radiated wave for finite beam lengths, the Cerenkov peak is broadened and the threshold energy is lowered. A criterion for the threshold energy is developed which is applicable to charged beams consisting of a single charge bunch of finite size, as well as beams consisting of periodically repeated bunches. Author (GRA)

N86-12026# California Univ., Berkeley. Lawrence Berkeley Lab.
MEDICAL HEAVY ION ACCELERATOR PROPOSALS
R. A. Gough May 1985 8 p refs Presented at the Particle Accelerator Conf., Vancouver, British Columbia, 13 May 1985
(Contract DE-AC03-76SF-00098)
(DE85-015247; LBL-18978; CONF-850504-236) Avail: NTIS HC A02/MF A01

For several decades, accelerators designed primarily for research in nuclear and high energy physics have been adapted for biomedical research including radiotherapeutic treatment of human diseases such as pituitary disorders, cancer, and more recently, arteriovascular malformations. The particles used in these treatments include pions, protons and heavier ions such as carbon, neon, silicon and argon. Maximum beam energies must be available to penetrate into an equivalent of about 30 cm of water, requiring treatment beams of 250 to 1000 MeV/nucleon. Intensities must be adequate to complete a 100 rad treatment fraction in about 1 minute. The favored technical approach in these proposals utilizes a conventional, strong-focusing synchrotron capable of fast switching between ions and energies, and servicing multiple treatment rooms. Specialized techniques for shaping the dose to conform to irregularly-shaped target volumes, while simultaneously sparing surrounding, healthy tissue and critical structures, are employed in each treatment room, together with the sophisticated dosimetry necessary for verification, monitoring, and patient safety. DOE

N86-12027# Sandia Labs., Albuquerque, N. Mex.
IFR GUIDING EXPERIMENTS
C. A. Frost, S. L. Shope, P. D. Kiekel, J. W. Poukey, C. A. Ekdahl, R. B. Miller, B. E. Godfrey, L. W. Wright, and B. B. Newberger 1985 13 p Presented at the SDIC/DARPA Ann. Propagation Rev., Monterey, Calif., 24 Jun. 1984 Prepared in cooperation with Mission Research Corp., Albuquerque, N. Mex.
(Contract DE-AC04-76DP-00789)
(DE85-014512; SAND-85-1450C; CONF-8506141-5) Avail: NTIS HC A02/MF A01

A new technique was developed for electrostatically guiding high-current electron beams in accelerators and for IFR (ion focused regime) propagation experiments. The new method allows transport of IREEs over curved paths for applications in circular accelerators such as Sandia's recirculating linac. This method uses a low-energy electron beam in place of a laser to ionize the channel and thereby allows the use of any background gas desired instead of being restricted to the use of organics with high-photoionization cross sections. A weak longitudinal magnetic field is applied to confine the low-energy beam, enabling one to precisely define the ionization channel. Using this method, a 1.2 MeV beam with currents exceeding 20 kA was guided over a 3-m straight path. In these experiments with high nu/(GAMMA) beams, the inductive erosion and the effects of ion mass on channel stability were observed. Both effects can be important for accelerator applications. DOE

N86-12028# Texas Univ., Bastrop. Center for Particle Theory.
REPRESENTATIONS OF THE GROUP OF DIFFEOMORPHISMS IN THE PHYSICS OF PARTICLES, GRAVITY AND FLUIDS
Y. Neeman Oct. 1984 14 p Prepared in cooperation with Ministry of Science and Development, Jerusalem
(Contract DE-AS05-76ER-03992)
(DE85-007031; DOE/ER-03992/569) Avail: NTIS HC A02/MF A01

The group of space-time diffeomorphisms is defined. The discovery of its double-covering group is reviewed and its representations are mentioned. Applications in several domains of physics are discussed. DOE

N86-12029# California Univ., Berkeley. Lawrence Berkeley Lab.
TWO-DIMENSIONAL LINACS
W. S. Cooper and C. A. Anderson May 1985 6 p refs Presented at the Particle Accelerator Conf., Vancouver, British Columbia, 13 May 1985
(Contract DE-AC03-76SF-00098)
(DE85-015129; LBL-18970; CONF-850504-210) Avail: NTIS HC A02/MF A01

Several schemes for RF acceleration of ribbon beams are described. (Although the ribbon edges of course, need to be focussed, these configurations are essentially 2-D). They allow simpler modeling than quadrupole systems and, if operable, provide good matching to certain types of ion sources and beam neutralizers. Four possible configurations are discussed, in chronological order of conception: (1) an RF linac with dc transverse field focussing; (2) a similar linac, also with many pairs of electrodes, but using RF focussing; (3) an RFQ-like configuration with continuous electrodes, in which energy changes slowly along the beam axis; and (4) a similar system in which the beam energy

oscillates along the axis. Some of the advantages and disadvantages of these systems are considered and the last case is analyzed in some detail. DOE

N86-12030# California Univ., Berkeley. Lawrence Berkeley Lab.
SOURCES OF RADIOACTIVE IONS
J. R. Alonso May 1985 7 p Presented at the Particle Accelerator Conf., Vancouver, British Columbia, 13 May 1985
(Contract DE-AC3-76SF-00098)
(DE85-015251; LBL-18958; CONF-850504-213) Avail: NTIS HC A02/MF A01

Beams of unstable nuclei can be formed by direct injection of the radioactive atoms into an ion source, or by using momentum of the primary production beam as the basis for the secondary beam. The effectiveness of this latter mechanism in secondary beam formation, i.e., the quality of the emerging beam (emittance, intensity, energy spread), depends critically on the nuclear reaction kinematics, and on the magnitude of the incident beam energy. When this beam energy significantly exceeds the energies typical of the nuclear process, many of the qualities of the incident beam can be passed on the secondary beam. Factors affecting secondary beam quality are discussed, along with techniques for isolating and purifying a specific secondary product. The ongoing radioactive beam program at the Bevalac is used as an example, with applications, present performance and plans for improvements. DOE

N86-12031# California Univ., Livermore. Lawrence Livermore Lab.
TRANSITION RADIATION AND COHERENT ELECTRON-PHOTON SCATTERING
M. J. Moran Apr. 1985 16 p Presented at the Penetration Phenomena Workshop, Oak Ridge, Tenn., 14 Apr. 1985
(Contract W-7405-eng-48)
(DE85-014813; UCRL-92912; CONF-850484-2) Avail: NTIS HC A02/MF A01

Relativistic electron irradiation of thin solid targets is known to generate collimated beams of X-ray photons in the forward direction by a number of different processes. A variety of mechanisms are discussed that share common characteristics in the angular and spectral distributions of the generated photon beams. Some simple physical explanations are offered for the characteristics shared by these processes. Some examples are then given based on experimental results attained at the LLNL electron-positron accelerator. DOE

N86-12032# Stanford Linear Accelerator Center, Calif.
DISRUPTION ANGLES
A. Minten 25 Jun. 1985 11 p refs
(Contract DE-AC03-76SF-0051)
(DE85-015138; SU-SLAC-CN-305) Avail: NTIS HC A02/MF A01

This investigation was stimulated by the question, to what extent beam disruption of two penetrating SLC bunches will modify the initial angular distribution of the incident beam, and whether the tails of the outgoing beam will be significantly enhanced and will lead to increased losses in the vicinity of the detector. An attempt was made to answer this question in three steps. DOE

N86-12033# Los Alamos Scientific Lab., N. Mex.
STUDY OF LAMPF H (-) BEAM POSITION MOTION AND A PREDICTIVE ALGORITHM FOR NOISE REDUCTION
V. Yuan and J. D. Bowman 1985 4 p Presented at the Particle Accelerator Conf., Vancouver, British Columbia, 13 May 1985
(Contract W-7405-eng-36)
(DE85-012701; LA-UR-85-1668; CONF-850504-80) Avail: NTIS HC A02/MF A01

The position noise in the LAMPF H(-) beam has been studied through examination of the autocorrelation and spectral-density functions for position motion. The LAMPF H(-) beam is a pulsed 800-MeV beam, and the position of each beam pulse was treated as a discrete value. Also investigated was the reduction in position noise that can be attained with an algorithm that predicts beam position from the measured positions of previous beam pulses. The basis for this predictive algorithm is the calculation of the optimal linear estimator. We conclude that the majority of low-frequency noise occurs within the 10- to 16-Hz frequency range, and that, with a simple, 2-pulse predictive correction system, one could improve the noise in this frequency region by as much as a factor of 15. DOE

N86-12034# Tufts Univ., Medford, Mass. Dept. of Physics.
AMPLITUDE TESTS OF DIRECT CHANNEL RESONANCES: THE DIBARYON
G. R. Goldstein, M. J. Moravosik, and F. Arash Feb. 1985 17 p refs Prepared in cooperation with Oregon Univ., Eugene
(Contract DE-AT06-76ER-70004)
(DE85-011478; DOE/ER-70004/T4) Avail: NTIS HC A02/MF A01

A recently formulated polarization amplitude test for the existence of one-particle-exchange mechanisms is modified to deal with direct-channel resonances. The results are applied to proton-proton elastic scattering at and around 800 MeV to test the suggested existence of a dibaryon resonance. This test is sensitive to somewhat different circumstances and parameters than the methods used in the past to find dibaryon resonances. The evidence, on the basis of the SAID data set, is negative for a resonance in any singlet partial wave, but is tantalizingly subliminal for a 3F3 resonance. DOE

N86-12035# Fermi National Accelerator Lab., Batavia, Ill.
REDUCTION OF SEXTUPOLE DISTORTION BY SHUFFLING MAGNETS IN SMALL GROUPS
R. I. Gluckstern and S. Ohnuma May 1985 4 p Presented at the Particle Accelerator Conf., Vancouver, British Columbia, 13 May 1985 Prepared in cooperation with Maryland Univ., College Park
(Contract DE-AC02-76CH-03000)
(DE85-013024; FNAL-TM-1312; CONF-850504-98) Avail: NTIS HC A02/MF A01

A method is given for reducing the most troublesome sextupole harmonics in a ring by measuring the sextupole field in groups of magnets, and ordering them according to a predetermined prescription. The predicted result is a decrease in sextupole related distortions by a factor (RADICAL)(2/(J+1)/SUP 1/2) where J magnets, covering one or more betatron periods, are measured at one time. Simulations performed for typical Superconducting Super Collider (SSC) lattices confirm the expected improvements. DOE

N86-12036# California Univ., Livermore. Lawrence Livermore Lab.
TRANSITION RADIATION AS A PRACTICAL X-RAY SOURCE
M. J. Moran and P. J. Ebert May 1985 14 p refs Presented at the 6th Symp. on X-and Gamma-Ray Sources and Appl., Ann Arbor, Mich., 21 May 1985
(Contract W-7405-eng-48)
(DE85-013201; UCRL-92017; CONF-850533-8) Avail: NTIS HC A02/MF A01

Transition radiation is generated when an energetic electron crosses the boundary between two different media. Theoretical calculations predict soft X-ray spectra and angular distributions that agree with experimental results. Further, recent advances in microstructure technology create the possibility of designing transition-radiation sources for several practical applications. For example, calculations indicate that a stack of 60 1 MU m-thick beryllium foils exposed to a beam of 100 MeV electrons will produce about 120 Joules of 1 to 2 keV X-rays per Coulomb of incident charge. The highest intensity sources appear to be bright enough for application to microlithography. DOE

N86-12037# Los Alamos Scientific Lab., N. Mex.
KINETICS ANALYSIS OF DIFFUSION OF POINT DEFECTS TO DISLOCATIONS FOLLOWING PULSED NEUTRON AND ELECTRON IRRADIATIONS
D. M. Parkin, J. A. Goldstone, H. M. Simpson, and J. W. Hemsky 1985 6 p Presented at the Conf. on Internal Friction and Ultrasonic Attenuation in Solids, Urbana, Ill., 3 Jun. 1985 Prepared in

cooperation with North Carolina Univ., Charlotte and Wright State Univ.
(Contract W-7405-eng-36)
(DE85-012768; LA-UR-85-1828; CONF-8506125-1) Avail: NTIS HC A02/MF A01

The kinetics of point defect-dislocation interactions following pulsed neutron and electron irradiations have been studied in high purity copper. In all experiments, data showed a very rapid increase in the modulus defect followed by a more gradual change. The magnitude of the rapid change in the modulus defect was proportional to the fluence. The initial rapid rise was too fast to allow for kinetics analysis; however, the slower continuous process was analyzed. Results are interpreted in terms of a model wherein interstitials are rapidly depleted and responsible for the initial rapid increase; the lower process is due to vacancy diffusion and arrival at dislocations. DOE

N86-12038# Brookhaven National Lab., Upton, N. Y.
AGS POLARIZED BEAM FACILITY
I. G. Ratner 1985 3 p Presented at the 6th Intern. Symp. on Polarization Phenomena in Nucl. Phys., Osaka, 26 Aug. 1985
(Contract DE-AC02-76CH-00016)
(DE85-011834; BNL-36425; CONF-850807-1) Avail: NTIS HC A02/MF A01

Two (MU)A of polarized H(-) were accelerated through the linac to 200 MeV a polarization of 65%. One (MU)A was injected into the AGS and acceleration began. The AGS polarized beam reached 13.8 GeV/c to eclipse the previous world's high energy of 12.75 GeV/c. The polarized beam energy is raised to 16.5 GeV/c at which energy it was decided to commence high energy physics running. The accelerated beam intensity exceeds 10 to the 10th power protons per pulse with about 40% polarization. DOE

N86-12039# Sandia Labs., Albuquerque, N. Mex.
CASCADE SWITCH IMPLEMENTATION OF PBFA 1
D. D. Bloomquist, G. R. Montry, S. E. Downie, and G. R. Peterson 1985 4 p Presented at the 5th IEEE Pulsed Power Conf., Washington, D.C., 10 Jun. 1985
(Contract DE-AC04-76DP-00789)
(DE85-013955; SAND-84-2459C; CONF-850616-52) Avail: NTIS HC A02/MF A01

The triggered gas switches in Particle Beam Fusion Accelerator (PBFA) 1 were recently changed from a single gap trigatron design to a 15-stage cascade design with a relatively short triggered gap. This improved design provides a low jitter value and has an extremely low probability of prefire. The triggered section represents about one-third of the total voltage of the switch and is triggered with a pin configuration similar to the previous trigatron design. The fields in the triggered gap were adjusted to allow prompt triggering and yet avoid prefires in the trigger gap at the operating gas pressure. Operating parameters of the switch will be discussed along with an analysis of the improved machine performance with respect to jitter, prefire probability, and operating voltage. DOE

N86-12040# California Univ., Berkeley. Electronics Research Lab.
SATURATION CHARACTERISTICS OF COUNTERSTREAMING WARM ELECTRONS
A. Wendt 28 May 1985 31 p
(Contract DE-AT03-76ET-53064)
(DE85-014390; DOE/ET-53064/T4) Avail: NTIS HC A03/MF A01

An investigation was made of the electron-electron two stream instability as the beam temperatures were increased, using particle simulations. Growth rates and saturation characteristics were studied and compared to theoretical models. The final state of the system, characterized by the value of the distribution function at zero velocity, f(upsilon = 0), was found to evolve to a Maxwellian in the cold case, and to a double-peaked distribution stable by the Penrose criterion in the warm cases. DOE

N86-12041# Brandeis Univ., Waltham, Mass. Dept. of Physics.
RESEARCH IN ELEMENTARY PARTICLE PHYSICS Technical Progress Report, 1 Jun. 1984 - 31 May 1985
L. E. Kirsch, H. J. Schnitzer, J. R. Bensinger, and L. F. Abbott 1985 29 p refs
(Contract DE-AC02-76FR-03230)
(DE85-014062; DOE/ER-03230/T4) Avail: NTIS HC A03/MF A01

Research performed on both the experimental and theoretical properties of elementary particles is briefly described, including: construction of forward electromagnetic shower counters; BO test facility; gas monitor development and production; off-line simulation work for trigger studies; hyperon weak radiative decay; search for dibaryons of strangeness = -1; study of the Skyrme model; collider physics; quarkonium spectroscopy; some theoretical studies of the standard model; and studies of cosomology, the cosmological constant, and scalar fields in curved space-time. DOE

N86-12042# Sandia Labs., Albuquerque, N. Mex.
IONIZATION-RAMAN DOUBLE-RESONANCE SPECTROSCOPY
P. Esherick and A. Owyoung 1985 5 p refs Presented at the 7th Intern. Conf. on Laser Spectroscopy, Maui, Hawaii, 24 Jun. 1985
(Contract DE-AC04-76DP-00789)
(DE85-013774; SAND-85-1347C; CONF-850605-2) Avail: NTIS HC A02/MF A01

Ionization detected stimulated Raman spectroscopy (IDSRS) is a new technique for high sensitivity, high resolution Raman studies based on resonant laser ionization/detection of vibrationally excited molecules. Results are presented on the application of IDSRS to the Raman spectroscopy of benzene. The spectra concentrate on the region near 1600 cm(-1) where the overlap of transitions to the (nu16, nu2 + nu18) Fermi dyad produces a particularly complex spectrum. By taking advantage of the double resonance capabilities of IDSRS, transitions are cleanly separated to each of the two vibrational bands, and thereby greatly simplify their spectra. DOE

N86-12001# Joint Publications Research Service, Arlington, Va.
COMPUTER APPLICATION IN ATOMIC ABSORPTION SPECTROMETRY
Hu Xinyao and Zhang Liangping *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-015) 16 May 1985 p 51-57 refs Transl. into ENGLISH from Fenxi Huaxue (Changchun), no. 6, 20 Jun. 1983 p 451-454 (For primary document see N86-11994 02-70)
Avail: NTIS HC A07/MF A01

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

N86-12043# Department of the Navy, Washington, D. C.
ION BEAM NEUTRALIZER Patent Application
J. E. Campana, inventor (to Navy) Filed 31 Oct. 1984 16 p
(AD-D011741; US-Patent-Appl-SN-666597) Avail: NTIS HC A02/MF A01 CSCL 20/3

A method and apparatus for converting an ion beam from a standard ion gun into a neutral particle beam by the processes of resonance neutralization followed by Auger deexcitation and/or Auger neutralization, established by directing the ion beam to pass in the proximity of a suitable metal surface are discussed.
Author (GRA)

N86-12044# Brookhaven National Lab., Upton, N. Y.
POSSIBILITIES OF POLARIZED PROTONS IN Sp ANTI p S AND OTHER HIGH ENERGY HADRON COLLIDERS
E. D. Courant 1985 3 p Presented at the 6th Intern. Symp. on High Energy Spin Phys., Marseille, 12 Sep. 1985 Prepared in

cooperation with State Univ. of New York, Stony Brook
(Contract DE-AC02-76CH-00016)
(DE85-012517; BNL-36181; CONF-8409162-15) Avail: NTIS HC A02/MF A01

The requirements for collisions with polarized protons in hadron colliders above 200 GeV are listed and briefly discussed. Particular attention is given to the use of the Siberian snake to eliminate depolarizing resonances, which occur when the spin precession frequency equals a frequency contained in the spectrum of the field seen by the beam. The Siberian snake is a device which makes the spin precession frequency essentially constant by using spin rotators, which precess the spin by 180 deg about either the longitudinal or transverse horizontal axis. It is concluded that operation with polarized protons should be possible at all the high energy hadron colliders. DOE

N86-12045# Los Alamos Scientific Lab., N. Mex.
STATUS OF FAST NEUTRON NUCLEAR DATA FOR (239)Pu
E. D. Arthur 1985 14 p Presented at the Intern. Conf. on Nucl. Data for Basic and Appl. Sci., Santa Fe, N. Mex., 13 May 1985
(Contract W-7405-eng-36)
(DE85-012699; LA-UR-85-1674; CONF-850507-30) Avail: NTIS HC A02/MF A01

Recent energy-averaged data (fission, total cross section, scattering and anti nu sub p) describing the interaction of fast neutrons with (239)Pu are discussed, with emphasis on neutron energies higher than the inelastic scattering threshold. The linkage between such experimental data and new theoretical calculations is described in context of their influence on a new revision to the ENDF/B-V (239)Pu evaluation. Results from this new revision are compared with other current (239)Pu evaluations. Incorporation of such information pertaining to neutron emission and anti nu sub p in the new ENDF revision had a profound impact on calculations performed for fast critical assemblies. Such calculational results are presented with emphasis on systematic improvements achieved in eigenvalues and fission ratios. DOE

N86-12046# Oak Ridge National Lab., Tenn.
LIQUID METAL REACTORS PROGRAMS: SAFEGUARDS AND PROGRAM ASSURANCE Technical Progress Report, Apr. 1985
W. L. Cooper, Jr. 17 May 1985 8 p
(Contract DE-AC05-84OR-21400)
(DE85-011002; ORNL/LMR/SP-85/4) Avail: NTIS HC A02/MF A01

Significant accomplishments and progress highlights concerning the development of standards for the liquid metal reactor program are presented. DOE

N86-12047# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
SURVEY OF ELEMENT AND ISOTOPE IMPORTANCE FOR FUSION SAFETY AND ENVIRONMENTAL ASSESSMENTS
S. J. Piet May 1985 34 p
(Contract DE-AC07-76ID-01570)
(DE85-012415; EGG-2393) Avail: NTIS HC A03/MF A01

A survey was made, using the most reliable information possible, to identify which elements and isotopes are potentially important for fusion safety and environmental assessments. It was determined that 51 elements may be exposed to fusion neutrons in either experimental devices or commercial reactors. These elements were prioritized by the relative probability of use. Also, 371 radioactive isotopes were identified that may be produced from these elements. These isotopes were prioritized by screening criteria that measured their relative importance to effluent assessments, accident assessments, and waste management assessments. Survey results presented in this report are prioritized lists of elements and isotopes of importance to neutronics researchers, effluent assessors, accident assessors, waste management assessors, maintenance assessors, and volatility and/or transport researchers. It is hoped that the results of this effort will lead to improved information in the various areas, which in turn will lead to better safety and environmental assessments. DOE

N86-12048# Los Alamos Scientific Lab., N. Mex.
APPLICATION OF DETAILED FISSION-PRODUCT DECAY GAMMA SPECTRA IN THE CALCULATION OF PHOTONEUTRON SPECTRA FROM D((GAMMA),n) REACTIONS IN PWR FUEL
W. B. Wilson, J. E. Stewart, T. R. England, and R. T. Perry 1985 5 p Presented at the Intern. Conf. on Nucl. Data for Basic and Appl. Sic., Santa Fe, N. Mex., 13 May 1985 Prepared in cooperation with Texas A&M Univ., College Station
(Contract W-7405-eng-36)
(DE85-012729; LA-UR-85-1729; CONF-850507-23) Avail: NTIS HC A02/MF A01

The magnitude, average neutron energy, and spectrum of the photoneutron source in a PWR fuel is calculated for shutdown times to 100 y using CINDER radionuclide inventory calculations, ENDF/B-V (GAMMA) line decay spectra, MCNP (GAMMA) transport calculations, and PHONEX D((GAMMA),n) reaction physics calculations. DOE

N86-12049# Stanford Linear Accelerator Center, Calif.
EXPERIMENTAL PROGRAM TO BUILD A MULTIMEGAWATT LASERTRON FOR SUPER LINEAR COLLIDERS
E. L. Garwin, W. B. Hermannsfeldt, C. Sinclair, J. N. Weaver, J. J. Welch, and P. B. Wilson Apr. 1985 4 p refs Presented at Particle Accelerator Conf., Vancouver, British Columbia, 13 May 1985
(Contract DE-AC03-76SF-00515)
(DE85-014293; SU-SLAC-Pub-3650; CONF-850504-192) Avail: NTIS HC A02/MF A01

A lasertron (a microwave triode with an RF output cavity and an RF modulated laser to illuminate a photocathode) is a possible high power RF amplifier for TeV linear colliders. As the first step toward building a 35 MW, S-band lasertron for a proof of principle demonstration, a 400 kV dc diode is being designed with a GaAs photocathode, a drift tube and a collector. After some cathode life tests are made in the diode, an RF output cavity will replace the drift tube and a mode-locked, frequency-doubled, Nd:YAG laser, modulated to produce a 1 us-long comb of 60 ps pulses at a 2856 MHz rate, will be used to illuminate the photocathode to make an RF power source out of the device. The plans for the project are discussed and numerical simulation studies results of the lasertron as well as some of the ultrahigh vacuum and mechanical design requirements for incorporating a photocathode are included. DOE

N86-12050# Stanford Linear Accelerator Center, Calif.
COLLINEAR WAKE FIELD ACCELERATION
K. I. F. Bane, P. Chen, and P. B. Wilson Apr. 1985 3 p refs Presented at Particle Accelerator Conf., Vancouver, British Columbia, 13 May 1985
(Contract DE-AC03-76SF-00515)
(DE85-014356; SU-SLAC-Pub-3662; CONF-850504-187) Avail: NTIS HC A02/MF A01

In the Voss-Weiland scheme of wake field acceleration a high current, ring shaped driving bunch is used to accelerate a low current beam following along an axis. In such a structure, the transformer ratio, i.e., the ratio of maximum voltage that can be gained by the on-axis beam and the voltage lost by the driving beam, can be large. In contrast, it was observed that for an arrangement in which driving and driven bunches follow the same path, and where the current distribution of both bunches is gaussian, the transformer ratio is not normally greater than two. Some of the possibilities and limitations of a collinear acceleration scheme are explored. In addition to its application to wake field acceleration in structures, this study is also of interest for the understanding of the plasma wake field accelerator. DOE

N86-12051# Oak Ridge National Lab., Tenn.
CALCULATIONS OF PHYSICAL AND CHEMICAL REACTIONS PRODUCED IN IRRADIATED WATER CONTAINING DNA
H. A. Wright, J. L. Magee, R. N. Hamm, A. Chatterjee, J. E. Turner, and C. E. Klots 1985 18 p refs Presented at the 9th Symp. on Microdosimetry, Toulouse, 20 May 1985 Prepared in cooperation

with California Univ., Berkeley. Lawrence Berkeley Lab.
(Contracts DE-AC05-84OR-21400; DE-AC03-76SF-00098)
(DE85-012899; CONF-850506-8) Avail: NTIS HC A02/MF A01

Initial results obtained with a Monte Carlo computer program designed to link initial physical events in irradiated liquid water with subsequent chemical and biological events are presented. A simple model for a segment of DNA was taken and calculations were performed for proton and alpha particles that traverse the medium at various distances from the DNA molecule. The number of chemical reactions were insulated. DOE

N86-12052# Oak Ridge National Lab., Tenn.
R-MATRIX ANALYSIS OF THE (239) Pu NEUTRON CROSS SECTIONS
G. Desaussure, R. B. Perez, and R. L. Macklin 1985 6 p refs Presented at the Intern. Conf. on Nucl. Data for Basic and Appl. Sci., Santa Fe, N. Mex., 13 May 1985 Prepared in cooperation with Tennessee Univ., Knoxville
(Contract DE-AC05-84OR-21400)
(DE85-013095; CONF-850507-39) Avail: NTIS HC A02/MF A01

Pu-239 neutron cross-section data in the resolved resonance region were analyzed with the R-Matrix Bayesian Program SAMMY. Below 30 eV the cross sections computed with the multilevel parameters are consistent with recent fission and transmission measurements as well as with older capture and alpha measurements. Above 30 eV no suitable transmission data were available and only fission cross-section measurements were analyzed. However, since the analysis conserves the complete covariance matrix, the analysis can be updated by the Bayes method as transmission measurements become available. To date, the analysis of the fission measurements was completed up to 300 eV. DOE

N86-12053# California Inst. of Tech., Pasadena. Lab. of Engineering Materials.
DOMINANT MOVING SPECIES IN THE FORMATION OF AMORPHOUS Nzr BY SOLID-STATE REACTION
Y. T. Cheng, W. I. Johnson, and M. A. Nicolet Jun. 1985 11 p
(Contract DE-AT03-81ER-10870)
(DE85-014855; DOE/ER-10870/155) Avail: NTIS HC A02/MF A01

The displacement of W and Hf makers were monitored by backscattering of MeV He. The growth of the amorphous NiZr phase was studied by solid-state reaction. It is found that the Ni is the dominant moving species in this reaction. DOE

N86-12054# Oak Ridge National Lab., Tenn.
CHEMICAL THERMODYNAMIC ASSESSMENT OF THE LI-U-O SYSTEM FOR POSSIBLE SPACE NUCLEAR APPLICATIONS
T. M. Besmann and R. H. Cooper, Jr. Jun. 1985 13 p
(Contract DE-AC05-84OR-21400)
(DE85-015060; ORNL/TM-9662) Avail: NTIS HC A02/MF A01

A thermochemical assessment of possible oxide fuel-lithium coolant interactions in conceptual 100-kW(e) space nuclear power reactors was performed. Results of the evaluation indicate that in the event of a cladding breach the fuel and coolant will interact with extremely negative consequences. The lithium has the potential to reduce the fuel to metallic uranium. Differences in temperature within the coolant loop can drive oxygen and uranium transport processes. DOE

N86-12055# Sandia Labs., Albuquerque, N. Mex.
MULTIDIMENSIONAL ION MICROBEAM ANALYSIS
B. L. Doyle 1985 25 p refs Presented at the 7th Intern. Conf. on Ion Beam Anal., Berlin, West Germany, 7 Jul. 1985
(Contract DE-AC04-76DP-00789)
(DE85-014699; SAND-85-0874C; CONF-850716-2) Avail: NTIS HC A02/MF A01

The nuclear microprobe is an instrument used to determine the atomic composition of the near-surface region of materials and is finding increasing use in a wide variety of scientific areas. When a scanning microprobe uses a depth-sensitive ion-beam analysis technique such as RBS, three dimensional analyses can be performed. This paper reviews current nuclear microbeam applications with emphasis on results involving such multidimensional profiling. DOE

N86-12056# Los Alamos Scientific Lab., N. Mex.
DOUBLE DIFFERENTIAL NEUTRON EMISSION CROSS SECTIONS OF (10)B AND (1)B AT 6, 10 AND 14 MeV AND OF (6)Li, (7)LI AND (12)C AT 14 MeV
M. Drosq, P. W. Lisowski, R. A. Hardegopf, D. M. Drake, and K. Treitl 1985 5 p Presented at the Intern. Conf. on Nucl. Data for Basic and Appl. Sci., Santa Fe, N. Mex. 13 May 1985 Prepared in cooperation with Wien Univ.
(Contract W-7405-eng-36)
(DE85-012749; LA-UR-85-1743; CONF-850507-28) Avail: NTIS HC A02/MF A01

Neutron emission spectra of (10)B and (11)B were measured at 6, 10, and 14.1 MeV and those of (6)li, (7)Li and carbon at 14.1 MeV using time-of-flight technique. Absolute double differential cross sections were obtained by emission cross sections. At 6 and 10 MeV excellent agreement with total cross section data is found, at 14.1 MeV the new data tend to be higher than expected. The biggest error source in the continuous spectra stems from uncertainties in the input library (FNDF/B-IV) of the Monte Carlo correction for multiple scattering. In particular, the library for (11)B appears to be very unrealistic, with a total elastic cross section at 14.1 MeV which should be higher by 50%. DOE

N86-12057# California Univ., Livermore. Lawrence Livermore Lab.
PHYSICS OVERVIEW OF AVLIS
R. W. Solarz Feb. 1985 18 p
(Contract W-7405-eng-48)
(DE85-014854; UCID-20343) Avail: NTIS HC A02/MF A01

Atomic vapor laster isotope separation (AVLIS) represents the largest-scale potential application of tunable lasers that has received serious attention. The underlying physical principles were identified and optimized, the major technology components were developed, and the integrated enrichment performance of the process was tested. The central physical processes are outlined, progress to date on the technology elements is reviewed, and scaling laws are fomulated. Two primary applications are the production of light-water reactor fuel and the conversion of fuel-grade plutonium to weapons-grade material. A variety of applications exist that all potentially use a common base of AVLIS technology. These include missions such as the enrichment of mercury isotopes to improve fluorescent lamp efficiency, the enrichment of iodine isotopes for medical isotope use, and the cleanup of strontium from defense waste for recovering strontium isotopes for radiothermal mechanical generators. The ability to radidly assess the economic and technical feasibility of each mission is derived from the general applicability of AVLIS physics and AVLIS technology. DOE

N86-12058# Sandia Labs., Albuquerque, N. Mex.
EXPERIMENTAL CHECK OF BREMSSTRAHLUNG DOSIMETRY PREDICTIONS FOR 0.75 MeV ELECTRONS
T. W. L. Sanford, J. A. Halbleib, and W. Beezhold 1985 28 p refs Presented at the 22nd Ann. Conf. on Nucl. and Space Radiation Effects, Monterey, Calif., 22 Jul. 1985
(Contract DE-AC04-76DP-00789)
(DE85-014706; SAND-85-0357C; CONF-850711-10) Avail: NTIS HC A03/MF A01

Bremsstrahlung dose in CaF2 TLDs from the radiation produced by 0.75 MeV electrons incident on Ta/C targets is measured and compared with that calculated via the CYLTRAN Monte Carlo code. The comparison was made to validate the code, which is used to predict and analyze radiation environments of flash X-ray simulators measured by TLDs. Over a wide range of Ta target thicknesses and radiation angles the code is found to agree with the 5% measurements. For Ta thickness near those that optimize the radiation output, however, the code overestimates the radiation dose at small angles. Maximum overprediction is about 14 + or - 5%. The general agreement, nonetheless, gives confidence in using

the code at this energy and in the TLD calibration procedure. For the bulk of the measurements, a standard TLD employing a 2.2 mm thick Al equilibrator was used. In this paper we also show that this thickness can significantly attenuate the free-field dose and introduces significant photon buildup in the equalibrator. DOE

N86-12059# Brookhaven National Lab., Upton, N. Y.
ANTINUCLEON-NUCLEUS ELASTIC AND INELASTIC SCATTERING
C. B. Dover and D. J. Millener 1985 25 p refs Presented at the Conf. on Antinucleon and Nucleon-Nucleus Interactions, Telluride, Colo., 18 Mar. 1985
(Contract DE-AC02-76CH-00016)
(DE85-012510; BNL-36438; CONF-850315-4) Avail: NTIS HC A02/MF A01

A general overview of the utility of antinucleon (anti N)-nucleus inelastic scattering studies is presented, emphasizing both the sensitivity of the cross sections to various components of the N anti N transition amplitudes and the prospects for the exploration of some novel aspects of nuclear structure. An examination of the relation between NN and N anti N potentials, focusing on the coherences predicted for the central, spin-orbit and tensor components, and how these may be revealed by measurements of two-body spin observables was conducted. The role of the nucleus as a spin and isospin filter, and how, by a judicious choice of final state quantum numbers (natural or unnatural parity states, isospin transfer (DELTA)T = 0 or 1) and momentum transfer g, one can isolate different components of the N anti N transition amplitude was discussed. Various models for the N anti N interaction which give reasonable fits to the available two-body data are shown to lead to strikingly different predictions for certain spin-flip nuclear transitions. The antinucleon and the nucleon were considered as a probe of nuclear modes of excitation. DOE

N86-12060# Massachusetts Inst. of Tech., Cambridge.
OVERVIEW OF MIT, ADIP IRRADIATION EXPERIMENTS
G. Kohse, O. K. Harling, and N. J. Grant Jun. 1985 5 p
(Contract DE-AC02-78ER-10107)
(DE85-014469; DOE/ER-10107/27) Avail: NTIS HC A02/MF A01

Various rapidly solidified austenitic, ferritic and copper alloys have been produced at MIT for inclusion in ADIP neutron irradiation experiments. A brief summary of the alloys and their preparation and the achieved or projected irradiation parameters is provided. DOE

N86-12061# Brookhaven National Lab., Upton, N. Y.
VACANCIES IN THERMAL EQUILIBRIUM IN Nb
B. Nielsen, K. G. Lynn, J. Hurst, A. Vehanen, and P. J. Schultz Jun. 1985 4 p Presented at the 7th Intern. Conf. on Positron Annihilation, New Delhi, 6 Jan. 1985 Prepared in cooperation with Helsinki Univ. and University of Western Ontario, London
(Contract DE-AC02-76CH-00016)
(DE85-014832; BNL-36699; CONF-850169-18) Avail: NTIS HC A02/MF A01

The diffusion of positrons in Nb-110 in the temperature range from 300K to 2450K utilizing a variable energy positron beam was measured. The vacancy formation was studied, however, no significant sign of vacancy trapping was observed. This could be due to a high detrapping rate caused by a low positron binding energy or due to a high vacancy formation enthalpy H sub IV sup F. The last possibility is consistent with recent studies of the vacancy migration and with calculation of the positron binding energy. It is found that H/sub IV sup F > 3 eV. DOE

N86-12062# Argonne National Lab., Ill.
Si(Li)-NaI(Tl) SANDWICH DETECTOR ARRAY FOR MEASUREMENTS OF TRACE RADIONUCLIDES IN SOIL SAMPLES
M. G. Strauss, I. S. Sherman, C. T. Roche, and R. H. Pehl (California Univ., Berkeley. Lawrence Berkeley Lab.) 1985 19 p refs Presented at 6th Symp. on X- and Gamma-Ray Sources and Appl., Ann Arbor, Mich., 21 May 1985
(Contract W-31-109-eng-38)
(DE85-013865; CONF-850533-10) Avail: NTIS HC A02/MF A01

An ultra-sensitive X-(gamma) ray detector system for assaying trace radioactivity in actinide contaminated soil and ash samples was developed. The new system consists of an array of 6 large Si(Li) X-ray detectors sensitive on both faces and mounted on edge in a paddle-shaped cryostat with a 14 cm dia Be window on each side. The paddle, with a sample of the soil placed at each window, is sandwiched between 2 large NaI(Tl) scintillators which suppress the (GAMMA) background. With X-rays being measured simultaneously from soil in 2 sample holders and background reduced by 50% using anticoincidence, the sensitivity of this detector is 4 times higher than that of conventionally mounted Si(Li) detectors. DOE

N86-12063# Colorado Univ., Boulder.
HIGH ENERGY PHYSICS Progress Report, Oct. 1984 - Jun. 1985
U. Nauenberg 2 Jul. 1985 38 p
(Contract DE-AC02-81ER-40025)
(DE85-014272; DOE/ER-40025/33) Avail: NTIS HC A03/MF A01

The tagged-photon beam effort consists of photoproduction and charm photoproduction. Progress in the broadband neutral beam program included setting up the production data analysis for hadronic charm production, and design, prototyping, procurement and fabrication of the electromagnetic calorimeter for photoproduction at the Tevatron. The electron-positron effort included data-taking and physics analysis, fabrication of a trigger/vertex drift chamber for the Mark II upgrade, and prototype studies. Studies included formal work in supergravity, supersymmetry phenomenology, lattice gauge theory approaches to hadronization, investigations of the behavior of the quark-gluon plasma in the early Universe, in heavy ion collisions, and on the lattice, and a first look at the real-time behavior of quantum systems out of thermal equilibrium. The equivalence of inertial and passive gravitational mass of high sensitivity in a cryogenic system is investigated. DOE

N86-12064# Argonne National Lab., Ill.
FEW-NUCLEON TRANSFER REACTIONS ON DEFORMED NUCLEI
A. M. vandenBerg 1985 29 p refs Presented at the Conf. on Nucl. Struct. with Heavy Ions, Padua, 27 May 1985
(Contract W-31-109-eng 38)
(DE85-013869; CONF-8505172-1) Avail: NTIS HC A03/MF A01

Development in nucleon transfer reactions on deformed nuclei were discussed. They include: alpha-transfer reactions on deformed nuclei, quasi-elastic neutron transfer reactions induced by (58)Ni beams on spherical and deformed samarium nuclei, and the population of low lying states in neutron rich nuclei using particle, GAMMA or particle, e coincidence methods. DOE

N86-12065# Argonne National Lab., Ill.
HIGH RESOLUTION SPECTROMETER IN STUDIES OF e(+)e(-) ANNIHILATION AT (RADICAL)s = 29 GeV
M. Derrick 3 May 1985 47 p refs Presented at the PEP High Luminosity Workshop, Stanford, Calif., 5-6 Apr. 1985
(Contract W-31-109-eng-38)
(DE85-013870; ANL/HEP-CP-85-45; CONF-8504155-1) Avail: NTIS HC A03/MF A01

The High Resolution Spectrometer is a general-purpose spectrometer which measures both charged particles and electromagnetic energy over 90% of the solid angle. The detection elements are in a 1.62-T magnetic field. The detector elements consist of a central drift chamber, an outer drift-chamber system, a barrel shower counter, and an end-cap shower-counter system. The goals of the program of research with the High Resolution Spectrometer include measurements of the electroweak coupling of the quarks and leptons, studies of the strong interactions of the quarks, and search for qualitatively new phenomena. DOE

N86-12066# Brookhaven National Lab., Upton, N. Y.
SPIN DEPENDENCE OF THE COHERENT SCATTERING

LENGTHS OF (27)Al AND ADMIXTURE OF s- AND d-PARTIAL WAVES

S. F. Mughab 1985 6 p Presented at the Intern. Conf. on Nucl. Data for Basic and Appl. Sci., Santa Fe, N. Mex., 13 May 1985
(Contract DE-AC02-76CH-00016)
(DE85-013299; BNL-NCS-36468; CONF-850507-36) Avail: NTIS HC A02/MF A01

A long standing discrepancy between measurements and calculations of the sign of the incoherent scattering length is attributed to two sources: (1) spin dependence of the potential scattering radius, and (2) identification of additional s-wave resonances at higher neutron energies. Detailed examination of the reaction Al-27 (n vector, (GAMMA) (28)Al induced by thermal neutrons revealed that R b +/ - R sub -/ = 0.32 +- 0.10 fm. Also shape fit analysis of the total cross section showed the presence of s-wave resonances at neutron energies 280, 386, 422, 491, 523, and 615 keV. One interesting outcome is the demonstration of the admixture of s- and d-wave partial waves in these resonances and the presence of a large d-wave neutron strength in the above energy region. DOE

N86-12067# California Univ., Berkeley. Lawrence Berkeley Lab.
MUON DECAY

H. Steiner Mar. 1985 9 p refs Presented at the 5th Moriond Workshop on Heavy Quarks, Flavor Mixing and CP Violation, La Plagne, France, 13 Jan. 1985
(Contract DE-AC03-76SF-00098)
(DE85-012590; LBL-19684; CONF-850171-2) Avail: NTIS HC A02/MF A01

Improved searches for rare processes in muon decay have substantially improved existing limits, but no evidence for any nonstandard behavior was found. The result of a recent sensitive search for right handed currents indicates that the ratio (V + A)-anokutyde/(V - A)-amplitude less than or equal to 0.029. This experiment also imposed new limits on nonstandard couplings and on the energy scales where lepton substructure and family symmetry breaking effects might manifest themselves. DOE

N86-12068# Fermi National Accelerator Lab., Batavia, Ill.
COLLIDER DETECTOR AT FERMILAB (CDF) Progress Report

D. Theriot Jun. 1985 14 p refs Presented at the Intern. Symp. on Phys. of Proton-Antiproton Collision, Tsukuba, Japan, 13-15 Mar. 1985
(Contract DE-AC02-76CH-03000)
(DE85-014423; FNAL/C-85/89; CONF-8503151-1) Avail: NTIS HC A02/MF A01

CDF, the Collider Detector at Fermilab, is a collaboration of almost 180 physicists from ten US universities, three US DOE supported national laboratories, Italy, and Japan. The primary physics goal for CDF is to study the general features of proton-antiproton collision at 2 TeV center-of-mass energy. On general grounds, it is expected that parton subenergies in the range 50 to 500 GeV will provide the most interesting physics at this energy. Work at the present CERN Collider has already demonstrated the richness of the 100 GeV scale in parton subenergies. DOE

74 OPTICS

Includes light phenomena.

N86-12069# Ceskoslovenska Akademie Ved, Ondrejov. Astronomical Inst.
PUBLICATIONS OF THE ASTRONOMICAL INSTITUTE OF THE CZECHOSLOVAK ACADEMY OF SCIENCES, NO. 61

1985 81 p refs
(Publ-61) Avail: NTIS HC A05/MF A01

An X-ray mirror system with mean resolution and a maximum effective collecting area for the spectral region of 1 to 10 nm is presented, and galvanoplastic grazing incidence mirrors for vertical experiments are discussed. For individual titles, see N86-12070 through N86-12071.

N86-12070# Ceskoslovenska Akademie Ved, Ondrejov. Astronomical Inst.
WOLTER 1 TYPE X-RAY MIRROR SYSTEM WITH MEAN RESOLUTION AND MAXIMUM EFFECTIVE COLLECTING AREA FOR THE SPECTRAL REGION OF 1-10 nm

R. Hudec, B. Valnicek, I. Solc, V. Landa, L. Svatek, R. Marecek, J. Urban, L. A. Vainshtein, M. E. Plotkin, M. M. Mitropolskii et al *In its* Publ. of the Astron. Inst. of the Czech. Acad. of Sci., No. 61 1985 p 1-41 refs (For primary document see N86-12069 02-74)
Avail: NTIS HC A05/MF A01

Parameter calculations of manufacturing procedure methods, and results are described for the Wolter 1 X-ray mirror system. The system consists of two nested pairs of mirrors: the outer pair has an input diameter of 24 cm and nickel coating, the inner pair has an input diameter of 13 cm and a gold coating. The focal distance is 41,9 cm, the length of each paraboloid and hyperboloid is 24 cm. Geometrical parameters of the mirrors are chosen to obtain a maximum effective area within the limits for overall dimensions. The mirrors are made as galavanic replicas with metallic reflecting surface and plastic base. The system is intended for use in the RT-4M X-ray telescope. E.A.K.

N86-12071# Ceskoslovenska Akademie Ved, Ondrejov. Astronomical Inst.
GALVANOPLASTIC GRAZING INCIDENCE MIRRORS FOR VERTICLE EXPERIMENTS: THE TANDEM TESTS IN SOFT X-RAYS

R. Hudec, B. Valnicek, I. Solc, M. M. Mitropolskii, I. A. Zhitnik, V. V. Krutov, and N. K. Sukhodrev *In its* Publ. of the Astron. Inst. of the Czech. Acad. of Sci., No. 61 1985 p 42-76 refs (For primary document see N86-12069 02-74)
Avail: NTIS HC A05/MF A01

The principles for calculating methodology, and laboratory tests results for grazing incidence mirrors used in solar X-ray telescopes installed in the Vertikal 8, Vertikal 9, and Vertikal 11 rockets launched as part of the Intercosmos program are described. The X-ray grazing incidence mirrors were developed by using galvanoplastic replica technology and tested according to a chart design with one of the investigated mirrors acting as a collimator. The advantages and drawbacks of this test method for X-ray mirrors are analyzed. E.A.K.

N86-12072# Clarkson Univ., Potsdam, N.Y.
ELASTIC AND INELASTIC LIGHT SCATTERING OF COLLOIDAL PARTICLES Final Report, 1982 - 1985

M. Kerker 10 Jun. 1985 6 p
(Contract DAAG29-82-K-0062)
(AD-A157335; ARO-18638.13-CH) Avail: NTIS HC A02/MF A01 CSCL 20/6

The project has been primarily concerned with both theoretical and experimental aspects of surface enhanced scattering. The theory has been extended to include concentric spherical particles, the effect of surface coverage, enhancement of coherent anti-Stokes Raman scattering and the effect of dielectric cavities. The experimental work included SERS (Surface Enhanced Raman Scattering) from citrate on silver hydrosols, surface enhanced resonance Raman scattering (SERRS) for dabsylaspartate on silver hydrosols, silver organosols and roughened silver electrodes, the effect of aggregates on SERS. In addition there have been ancillary studies dealing with absorption and luminescence by dye coated silver particles, analysis of biological cells by flow fluorimetry, and electromagnetic scattering by magnetic particles. Author (GRA)

N86-12073# Office of the Under Secretary of Defense for Research and Engineering, Washington, D. C.
ELECTRO-OPTICS MILLIMETER/MICROWAVE TECHNOLOGY IN JAPAN. REPORT OF DOD TECHNOLOGY TEAM Final Report, Jul. 1984 - May 1985

J. M. MacCallum, Jr., G. Nicholas, S. Musa, T. Hartwick, and B. Spielman May 1985 54 p
(AD-A157376) Avail: NTIS HC A04/MF A01 CSCL 20/6

This document is a report on the first DOD technology team

review of Japanese programs in electro-optical (EO) millimeter and microwave technology of interest to the Department of Defense. The team visited Japan during July 1984 and April 1985 and reviewed EO/MMW activities at a number of companies and government research centers. GRA

N86-12074# Georgia Inst. of Tech., Atlanta. School of Geophysical Sciences.
ANALYSIS OF ARCTIC HAZE SCATTERING AND AEROSOL DATA OBTAINED DURING AGASP Final Report, 16 Sep. 1983 - 15 Sep. 1984
E. M. Patterson and G. W. Grams 1 May 1985 46 p
(Contract DAAG29-83-K-0163)
(AD-A157434; ARO-21001.1-GS) Avail: NTIS HC A03/MF A01 CSCL 20/6

We have analyzed polar nephelometer scattering data to infer radiative parameters for the Arctic haze aerosols. We have also used the scattering properties as measured with the nephelometer as well as other measurements of aerosol microphysical properties to improve our estimates of aerosol properties for radiative modeling. We have confirmed earlier estimates of the submicron size distribution and have demonstrated the uniformity of these distributions. We have also shown that the giant particles also have relatively uniform size distributions and have provided an estimate of the infrared effects due to these particles. We have also demonstrated an inconsistency in two of the AGASP data sets and have resolved the discrepancy in terms of the measurement limitations of the data set. GRA

N86-11985# Joint Publications Research Service, Arlington, Va.
PHOTOINDUCED RAYLEIGH SCATTERING OF LIGHT IN CRYSTALS Abstract Only.
V. V. Obukhovskiy and A. V. Stoyanov *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 97 p 97 Transl. into ENGLISH from Opt. i Spektrosk. (Leningrad), v. 58, no. 2, Feb. 85 p 3780-385 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

N86-11986# Joint Publications Research Service, Arlington, Va.
MULTIPHOTON RAMAN SCATTERING OF LIGHT EXCITED IN CRYSTALS BY A COPPER-VAPOR LASER Abstract Only.
A. M. Agaltsov, V. S. Gorelik, and M. M. Sushchinskiy *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 98 p 98 refs Transl. into ENGLISH from Opt. i Spektrosk. (Leningrad), v. 58, no. 2, Feb. 85 p 386-389 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

N86-11987# Joint Publications Research Service, Arlington, Va.
PHASING OF MULTIPLE-APERTURE OPTICAL SYSTEMS Abstract Only.
P. A. Bakut, A. D. Rayakin, K. N. Sviridov, and N. D. Ustinov *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 98 refs Transl. into ENGLISH from Opt. i Spektrosk. (Leningrad), v. 58, no. 2, Feb. 1985 p 445-448 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

N86-11988# Joint Publications Research Service, Arlington, Va.
TRANSFORMATION OF LIGHT PULSE SHAPE BY THIN PLANE-PARALLEL LAYER OF ABSORBING MATERIAL Abstract Only
N. I. Insarova and G. I. Olefir *In its* USSR Rept.: Phys. and Math. (JPRS-UMP-85-005) 20 Aug. 1985 p 101 refs Transl. into ENGLISH from Zh. Prikl. Spektrosk. (Minsk, USSR), v. 42, no. 2, Feb. 1985 p 255-259 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N86-12075# Naval Research Lab., Washington, D. C.
A HYBRID MODE AND A CLASSIFICATION OF BEAM PLASMA INSTABILITIES
Y. Y. Lau 11 Jul. 1985 39 p
(ARPA Order 4395)
(AD-A157356; NRL-MR-5601) Avail: NTIS HC A03/MF A01 CSCL 20/9

The interactions of an electron beam with a background plasma are classified according to the beam energy and to the relative density of the beam and the plasma. Both the electron beam and plasma are assumed to be cold, unmagnetized, collisionless, and all equilibrium self-fields have been assumed negligible. Emphasis is placed on the dynamical coupling of longitudinal and transverse motions as a result of relativistic and electromagnetic effects. Over many orders of magnitudes, we find that the parameter space may be divided into just a few domains, with different instability mechanisms. The boundaries separating these domains are given, together with the instability growth rates and the characteristic wave number of the instability within each of these domains. This classification thus provides an immediate assessment of the nature specified. In addition to the classical two stream instabilities and the Weibel type instabilities, a new mode, temporarily called the hybrid mode, is discovered. The hybrid mode is dominant when the electron beam is highly relativistic. We provide several examples of current interest to demonstrate the use of this classification. The results have been tested against the dispersion relationship given by Tajima, Jones and Shoucri. Effects of a finite beam are discussed. GRA

N86-12076# Michigan Univ., Ann Arbor. Coll. of Engineering.
NEUTRAL BEAM INTERACTIONS WITH MATERIALS Annual Progress Report, 1 Jun. 1984 - 31 May 1985
R. M. Gilgenbach and J. J. Duderstadt 18 Jun. 1985 61 p
(Grant AF-AFOSR-0130-84)
(AD-A157445) Avail: NTIS HC A04/MF A01 CSCL 20/8

This annual report describes experimental and theoretical research which concerns the interaction of neutral or ion beams with surface ablation plasmas. This problem is of interest in the case of particle penetration to outgassing or ablating objects in a high vacuum environment. We have constructed a neutral beam-ablation plasma experiment which employs a Q-switched ruby laser to independently generate a dense ablation plasma. GRA

N86-12077# Naval Research Lab., Washington, D. C.
SIMPLODE: AN IMPLODING GAS PUFF PLASMA MODEL. 1: NEON
J. Davis, C. Agritellis, and D. Duston 26 Jul. 1985 46 p
(AD-A157456; NRL-MR-5615) Avail: NTIS HC A03/MF A01 CSCL 20/9

A non-LTE dynamic pinch model - SIMPLODE - has been developed and applied to describing the implosion dynamics of a K-shell radiating gas puff. Numerical simulations have been carried out with neon gas puffs and compared with recent experimental results obtained on GAMBLE II. In addition, the influence of the Plasma Erosion Opening Switch on the K-shell yield is investigated. Author (GRA)

N86-12078# Naval Research Lab., Washington, D. C.
THE IONIZATION EQUILIBRIUM OF OPTICALLY THICK ARGON z-PINCH PLASMAS FOR ELECTRON TEMPERATURES BETWEEN 25 AND 65 eV
J. P. Apruzese, P. C. Kepple, and J. Davis 2 Jul. 1985 27 p
(AD-A157484; NRL-MR-5609) Avail: NTIS HC A03/MF A01 CSCL 20/9

Calculations of the ionization balance of optically thick argon plasmas of electron temperature 25-65 eV are presented. A multistage, multilevel model of argon ions with accurate radiation

transport of about 50 lines in the sodium, neon, and flourine-like stages forms the basis of the calculations. By comparison with similar optically thin calculations, the effects on ionization of radiative and collisional pumping of excited states of these stages is delineated. In particular, the broad temperature distribution of the neon-like stage is compressed by line photon pumping to a narrower regime of existence because of ionization from the excited states. The relevance to the 3p-3s lasing scheme in neon-like argon is briefly discussed. Author (GRA)

N86-12079# Naval Research Lab., Washington, D. C.
TOTAL AND PARTIAL ABSORPTION COEFFICIENTS FOR A NITROGEN PLASMA Memorandum Report, 1984 - 1985
R. D. Taylor and A. W. Ali 2 Jul. 1985 52 p
(ARPA Order 4395)
(AD-A157534; NRL-MR-5607) Avail: NTIS HC A04/MF A01 CSCL 20/9

A detailed description of the absorption cross sections in a nitrogen plasma is given. The results are presented for partial and total absorption coefficients, where the components are the bound-bound, the bound free and the free-free absorptions. Use is made of nitrogen plasma composition as a function of the electron density and temperature calculated earlier. GRA

N86-12080# Naval Research Lab., Washington, D. C.
ADVANCED CONCEPTS THEORY ANNUAL REPORT, 1984 Memorandum Report, Jan. - Dec. 1984
26 Jun. 1985 145 p
(AD-A157535; NRL-MR-5590) Avail: NTIS HC A07/MF A01 CSCL 20/9

This volume of the Annual Final Report contains the results of a number of theoretical issues related to the radiative properties and X-ray conversion efficiency of dense hot plasmas. In particular, numerical simulations and analyses are presented for the radiative properties of gas puff mixtures, the dynamics of imploding gas puff plasmas, the implosion dynamics of stagnating gas puff plasmas, the influence of radiation on the velocity scaling of gas puff implosions and radiation from an ion beam target interaction. The following topics include: radiative properties of puffed-gas mixtures; optically thin case; modeling of K-shell yields; dynamics of imploding Z-pinch; implosion of a neon puff-gas plasma onto a low-density plasma; velocity scaling of the radiatively dominated Z-pinch; and Ion-beam deposition, Heating, and radiation from an aluminum plasma. GRA

N86-12081# Massachusetts Inst. of Tech., Cambridge. Plasma Fusion Center.
MHD STABILIZATION OF HIGH (BETA) MIRROR PLASMA PARTIALLY ENCLOSED BY CONDUCTING WALL
X. Z. Li, J. Kesner, and B. Lane Apr. 1985 23 p Presented at the Sherwood Theory Conf., Madison, Wisc., 15 Apr. 1985
(Contract DE-AC02-78ET-51013)
(DE85-015579; DOE/ET-51013/148; PFC/CP-85-2; CONF-850474-1) Avail: NTIS HC A02/MF A01

An MHD formulation is used to study a wall stabilized high (BETA) mirror plasma with isotropic pressure. The stabilizing wall extends axially only a part of the distance between the mirror midplane and throat. This arrangement was modeled using a wall that approaches the plasma surface in the bad curvature region and is distant from the plasma in the good curvature region. A variational method is used to solve the equation in the distant wall region and an iterative method is used to solve the equation when the wall is close to the plasma. A jump condition is used to connect the regions of close and distant plasma-wall proximity. A simple trial function is used to perform the variational calculation (the choice of trial function is substantiated by an exact numerical solution). The results show that for a low mirror ratio case more conducting wall surface is needed for stability than in the high mirror ratio case. This agrees with the physical mechanism of the wall stabilization. DOE

N86-12082# Oak Ridge National Lab., Tenn.
EFFECTS OF TRAPPED ALPHA PARTICLES ON BALLOONING MODES IN TOKAMAKS
D. A. Spong, D. J. Sigmar, W. A. Cooper, D. E. Hastings, and K. T. Tsang Jul. 1985 34 p
(Contract DE-AC05-84OR-21400)
(DE85-015064; ORNL/TM-9598) Avail: NTIS HC A03/MF A01

The effects of a trapped, precessing alpha particle population on ballooning modes are examined for a large-aspect-ratio, shifted circular flux surface tokamak equilibrium. The alphas are modeled in the deeply trapped limit and with a Maxwellian distribution in energy. The resulting kinetic ballooning equation is solved numerically, and the dependence of the eigenvalues and stability boundaries on shear, background pressure gradient, and ratio of hot to background temperatures and densities is investigated. In the low-frequency regime LC OMEGA <LC OMEGA sub dH sub dH = alpha precessional drift frequency, the alpha component has a stabilizing influence, while in the intermediate-frequency range <LC OMEGA less than or equal to <LC OMEGA sub dH the alphas destabilize ballooning modes through interaction with the trapped particle precessional drift resonance. Parameter ranges that should be typical of alpha production in near-term tokamak devices such as the Tokamak Fusion Test Reactor (TFTR) are considered. DOE

N86-12083# Massachusetts Inst. of Tech., Cambridge. Plasma Fusion Center.
IMPLICATIONS OF RF CURRENT DRIVE THEORY FOR NEXT STEP STEADY-STATE TOKAMAK DESIGN
J. H. Schultz Jun. 1985 60 p
(Contract DE-AC02-78ET-51013)
(DE85-014753; DOE/ET-51013/T3; PFC/RR-85-2) Avail: NTIS HC A04/MF A01

Two missions have been identified for a next-step tokamak experiment in the United States. The more ambitious Mission II device would be a superconducting tokamak, capable of doing long pulse ignition demonstrations, and hopefully capable of also being able to achieve steady state burn. A few interesting lines of approach were identified, using a combination of logical design criteria and parametric system scans. These include: (1) TIBER: A point design that proposes a machine with the capability of demonstrating ignition, high beta (10%) and high Q (=10), using high frequency, fast wave current drive; (2) JET Scale-up; (3) Magic 5: It is argued here that an aspect ratio of 5 is a magic number for a good steady state current drive experiment; and (4) ET-II: The concept of a highly elongated tokamak (ET) was first proposed as a low cost approach to Mission I, because of the possibility of achieving ohmic ignition with low stress copper magnets. Its best application is for commercial tokamaks, using fast wave current drive. A Mission II experiment that would be prototypical of such a reactor is suggested. DOE

N86-12084# Texas Univ., Austin. Inst. for Fusion Studies.
PLASMA KINETIC THEORY IN ACTION-ANGLE VARIABLES
S. M. Mahajan and C. Y. Chen Jun. 1985 23 p
(Contract DE-FG05-80ET-53088)
(DE85-014767; DOE/ET-53088/194; IFSR-194) Avail: NTIS HC A02/MF A01

An appropriate canonical perturbation theory to correctly deal with general electromagnetic field perturbation is developed, and is used to set up plasma kinetic theory in action-angle variables. A variety of test problems are solved to show the unifying power of the method. Basic linear, quasilinear, and nonlinear equations are derived which can serve as the starting point for a whole range of plasma problems. DOE

N86-12085# Oak Ridge National Lab., Tenn.
TOKAMAK STARTUP: PROBLEMS AND SCENARIOS RELATED TO THE TRANSIENT PHASES OF IGNITED TOKAMAK OPERATIONS
J. Sheffield 1985 37 p Presented at the Workshop on Tokamak Start-Up - Probl. and Senarios Related to the Transient Phases of Long-Burn Operations, Erice, Italy, 14 Jul. 1985
(Contract DE-AC05-84OR-21400)
(DE85-015321; CONF-850708-1) Avail: NTIS HC A03/MF A01

During recent years improvements have been made to tokamak startup procedures, which are important to the optimization of ignited tokamaks. The use of RF-assisted startup and noninductive current drive has led to substantial reduction and even complete elimination of the volt-seconds used during startup, relaxing constraints on poloidal coil, vacuum vessel, and structure design. This paper reviews these and other improvements and discusses the various bulk heating techniques that may be used to ignite a D-T plasma. DOE

N86-12086# TRW, Inc., Redondo Beach, Calif.
PHYSICS MODELING OF TANDEM MIRROR DEVICES WITH HIGH FIELD TEST CELL INSERTS
M. E. Fensternmacher and R. B. Campbell 15 Apr. 1984 64 p refs Prepared in cooperation with California Univ., Berkeley. Lawrence Livermore Lab.
(Contract W-7405-eng-48)
(DE85-011870; UCID-20405) Avail: NTIS HC A04/MF A01

Recently developed plasma physics models of tandem mirror operation with a high-field technology test cell insert in the central cell are described in detail. These models were incorporated in the TMRBAR tandem mirror reactor physics code. Results of a benchmark case for the code models against previous analysis of the MFTF - (ALPHA) (+) T configuration are given. A brief users guide to the new TMRBAR with the test cell models is also presented. Some description of the applications of the models to MFTF - (ALPHA) (+) T and FPD - II + T configurations is made. DOE

N86-12087# California Univ., Livermore. Lawrence Livermore Lab.
MIRROR FUSION TEST FACILITY (MFTF-B): STATUS
V. N. Karpenko Feb. 1985 7 p Presented at the 6th Topical Meeting on the Technol. of Fusion Energy, San Francisco, 3 Mar. 1985
(Contract W-7405-eng-48)
(DE85-012953; UCRL-92247; CONF-850310-107) Avail: NTIS HC A02/MF A01

The Mirror Fusion Test Facility (MFTF-B), now under construction at Lawrence Livermore National Laboratory, represents more than an order-of-magnitude step up from earlier magnetic mirror experiments on the way to a future mirror fusion reactor. In fact, when the device begins operating in 1988, it will be capable of achieving plasma performance approaching scientific breakeven for D-T equivalent operation. We have taken major steps to develop MFTB-B technologies for tandem mirrors. In the machine, we will use steady-state, high-field, superconducting agents on reactor-relevant scales. The 30-s beam pulses, ECRH, and ICRH will also introduce near steady-state technologies into those systems. DOE

N86-12088# Kanner (Leo) Associates, Redwood City, Calif.
DISCUSSION OF THE CURRENT LIMITS IN THE RFQ
A. Schemmp 1985 7 p Transl. into ENGLISH of "Zur Diskussion der Stromgrenzen in RFQ" rept. 85-1 Inst. fuer Angewandte Phys. der Univ. Frankfurt/Main, Jan. 1985
(Contract W-7405-eng-36)
(DE85-012909; LA-tr-85-22) Avail: NTIS HC A02/MF A01

During the introduction of the SNQ injector, various reasons were given for the structure selection without any discussion. Moreover, a current equation: I approx. V/f (e/E sub k) squared was employed without any indication of the boundary conditions, indicating that a 200 MHz-RFQ is not possible for the SNQ. On the one hand, there is a proposal for a 200 MHz high-current RFQ (CERN RFQ II); on the other hand, Junior indicates a RFQ current proportional to the vane voltage. Simple considerations demonstrate the limits of the simple assumption in equation one. When the design values in literature are compared, the linear relationship of Junior is confirmed, i.e., that the longitudinal current I1 essentially provides the limit, the radial increase does not have an effect because of the alteration in the cos(MU). DOE

N86-12089# Oak Ridge National Lab., Tenn.
VARIABLE FIELD MAGNETIC EXTRACTION CHANNEL FOR ORIC
E. D. Hudson, J. A. Martin, and R. S. Lord 1985 3 p refs Presented at the Particle Accelerator Conf., Vancouver, British Columbia, 13 May 1985
(Contract DE-AC05-84OR-21400)
(DE85-011927; CONF-850504-34) Avail: NTIS HC A02/MF A01

An improved magnetic beam extraction channel for the Oak Ridge Isochronous Cyclotron (ORIC) was designed to significantly reduce the external field disturbance and provide uniform in-channel field. This will make beam extraction near nu sub r = 1 more predictable. The new channel consists of an iron tube of constant cross section with independently adjustable windings, both inside and outside the iron. The windings have a cos theta current density distribution. The iron tube is 1 meter long with a bore of 6 cm; aperture for beam is 4 cm. The external field is negligible except for small perturbations in the field arising from the geometry modifications required at the ends so that the beam can enter and leave. The field reduction inside the channel is variable from 0.4 to 0.6 Tesla without significant change in either the internal field uniformity or the external field level. DOE

N86-12090# Sandia Labs., Albuquerque, N. Mex.
PBFA-2 VACUUM INSULATOR STACK FAILURE MECHANISMS
M. A. Sweeney 1985 14 p Presented at the 5th IEEE Pulsed Power Conf., Washington, D.C., 10 Jun. 1985
(Contract DE-AC04-76DP-00789)
(DE85-013118; SAND-84-2567C; CONF-850616-23) Avail: NTIS HC A02/MF A01

The BPFA-II accelerator includes a large-radius, vertical-axis vacuum insulator stack. The possible failure of the acrylic rings in the stack from electron- or gamma-induced charge buildup is being evaluated. The induced static charges could remain for many hours, and either type of irradiation might cause dendrites to form. Aluminum grading rings sandwiched between the acrylic affect charge accumulation; the acrylic would preferentially break down to these grading rings. The charge buildup and the bremsstrahlung dose could depend critically upon the directionality and position of the electron loss. The effects of electron loss that occurs in the vicinity of the ion diode, where the electrons have energies of about 30 MeV are considered. Monte Carlo electron-photon transport calculations indicate that the bremsstrahlung dose expected in an acrylic ring once diode experiments begin in 1986 could be as much as 5 krads per shot, with roughly half of the photon energy above 5 MeV. Moreover, the calculation indicate that the charge deposition in an individual acrylic ring might exceed 2x10 to the 11 electrons/sq cm. DOE

N86-12091# Stanford Linear Accelerator Center, Calif.
INCREASED INTENSITY PERFORMANCE OF THE BROOKHAVEN AGS
E. Raka, L. Ahrens, W. Frey, E. Gill, J. W. Glenn, R. Sanders, and W. T. Weng May 1985 4 p refs Presented at the Particle Accelerator Conf., Vancouver, British Columbia, 13 May 1985 Prepared in cooperation with BNL
(Contract DE-AC03-76SF-00515)
(DE85-013371; SU-SLAC-PUB-3689; CONF-850504-71) Avail: NTIS HC A02/MF A01

With the advent of H(-) injection into the Brookhaven AGS, circulating beams of up to 3 x 10(13) protons at 200 MeV have been obtained. RF capture of 2.2 x 10(13) and acceleration of 1.73 x 10(13) up to the transition energy (approx. = 8 GeV) and 1.64 x 10(13) to full energy (approx. = 29 GeV) has been achieved. This represents a 50% increase over the best performance obtained with H(+) injection. The increase in circulation beam current is obtained without filling the horizontal aperture. This allows the RF capture process to utilize a larger longitudinal phase space area (approx. = 1 eV sec/bunch vs less than or equal to 0.6 eV sec with H(+) operation). The resulting reduction in relative longitudinal density partially offsets the increase in space charge effects at higher currents. In order to make the capture process

independent of injected beam current, a dynamic beam loading compensation loop was installed on the AGS RF system. This is the only addition to the synchrotron itself that was required to reach the new intensity records. A discussion of injection, the RF capture process, and space charge effects is presented. DOE

N86-12092# Sandia Labs., Albuquerque, N. Mex.
DESIGN AND OPTIMIZATION OF THE PBFA 2 VACUUM INTERFACE AND TRANSMISSION LINES FOR LIGHT ION FUSION
D. B. McDaniel, R. W. Stinnett, and E. W. Gray 1985 22 p Presented at the 5th IEEE Pulsed Power Conf., Washington, D.C., 10 Jun. 1985 Prepared in cooperation with Cornell Univ., Ithaca, N.Y.
(Contract DE-AC04-76DP-00789)
(DE85-012809; SAND-84-2560C; CONF-850616-5) Avail: NTIS HC A02/MF A01

The PBFA II vacuum insulator was originally designed for optimum coupling to a proton ion diode with minimum inductance. In July 1983 it was decided that lithium ions at 30 MeV would be the baseline for PBFA II. This requires the use of plasma opening switches (POS) and vacuum inductor to reach 30 MV. To achieve this, the vacuum magnetically insulated transmission lines had to be redesigned as an inductive energy store. To gain optimum coupling to this vacuum inductors, the output impedance of the water section was increased by the use of a water-dielectric transformer. The calculations leading to the final design will be discussed. DOE

N86-12093# Los Alamos Scientific Lab., N. Mex.
LOS ALAMOS PROTON STORAGE RING FAST-EXTRACTION KICKER SYSTEM
J. F. Power, B. Blind, and A. J. Jason May 1985 4 p refs Presented at the Particle Accelerator Conf., Vancouver, British Columbia, 13 May 1985
(Contract W-7405-eng-36)
(DE85-012663; LA-UR-85-1614; CONF-850504-52) Avail: NTIS HC A02/MF A01

We describe the kicker system used by the Los Alamos Proton Storage Ring (PSR) for fast extraction of accumulated 800-MeV proton beam. The system has several severe constraints in terms of rise time, field quality, and magnet dimensions. These are, in turn, defined by characteristics of the stored beam, ring lattice, and the allowable activation of ring components. Design methods to meet the constraints are outlined here and we describe the novel modulators that produce the fast pulses required. DOE

N86-12094# California Univ., Livermore. Lawrence Livermore Lab.
ELECTRICAL SUPPLY FOR MFTF-B SUPERCONDUCTING MAGNET SYSTEM
D. W. Shimer and E. W. Owen 13 Feb. 1985 8 p Presented at the Workshop on Power Supplies for Fusion Expt., Los Alamos, N. Mex., 20 Feb. 1985
(Contract W-7405-eng-48)
(DE85-012932; UCRL-92156; CONF-850285-1) Avail: NTIS HC A02/MF A01

The MFTF-B magnet system consists of 42 superconducting magnets which must operate continuously for long periods of time. The magnet power supply system is designed to meet the operational requirements of accuracy, flexibility, and reliability. The superconducting magnets require a protection system to protect against critical magnet faults of quench, current lead overtemperature, and overcurrent. The protection system is complex because of the large number of magnets, the strong coupling between magnets, and the high reliability requirement. The power circuits and the components used in the design are described. DOE

N86-12095# Brookhaven National Lab., Upton, N. Y.
WINDOW FRAME OR SUPERFERRIC MAGNET DESIGN FOR LOW B(<3T) HEAVY ION STORAGE RING STUDY
G. Danby, B. DeVito, J. Jackson, G. Keohane, Y. Lee, R. Phillips, S. Plate, L. Repata, J. Skaritka, and L. Smith 1985 3 p refs Presented at the Particle Accelerator Conf., Vancouver, British Columbia, 13 May 1985
(Contract DE-AC02-76CH-00016)
(DE85-013288; BNL-36557; CONF-850504-154) Avail: NTIS HC A02/M A01

Double magnets share common laminations without magnetic coupling. Single layer coils of rectangular conductor are dry wound on extruded bore tubes. Magnet construction requires no molding or prestress. Absence of superconducting (SC) magnetization fields in the aperture results in very large dynamic range. The coil is wound continuously across the modplane to give unusually large dynamic aperture. Above approx. 2.2 T saturation is corrected by simple sextupole windings with no inductive coupling to the dipole. Ultrastable design requires no internal quench protection. A quadrupole pair of novel design gives excellent field quality to B . 2 T without corrections, with no SC magnetization. Experience shows magnets are accurate enough for the assembly to take place at its final location. No training is required. Test procedures (measurements with search coils or with the beam) and cooldown properties are discussed. DOE

N86-12096# Los Alamos Scientific Lab., N. Mex.
LOS ALAMOS SPHEROMAK PROGRAM
T. R. Jarboe 1985 7 p Presented at the 7th US Symp. on Compact Toroid Res., Santa Fe, N. Mex., 21 May 1985
(Contract W-7405-eng-36)
(DE85-012769; LA-UR-85-1822; CONF-8505100-10) Avail: NTIS HC A02/MF A01

The Los Alamos Spheromak has two experimental facilities. The confinement properties of sustained and decaying spheromaks are being studied in CTX. Electrodes for the production of clean sustained spheromaks are being developed on the Electrode Studies Facility. DOE

N86-12097# Stanford Linear Accelerator Center, Calif.
STATUS OF SLC
S. D. Ecklund May 1985 4 p Presented at the Particle Accelerator Conf., Vancouver, British Columbia, 13 May 1985
(Contract DE-AC03-76SF-00515)
(DE85-013071; SU-SLAC-PUB-3679; CONF-850504-138) Avail: NTIS HC A02/MF A01

The current construction status of the Stanford Linear Collider (SLC) is described along with a brief overview of the project. Tests of completed parts of the machine are summarized. DOE

N86-12098# Fermi National Accelerator Lab., Batavia, Ill.
SSC TEST LATTICES
E. D. Courant, D. R. Douglas, A. A. Garren, and D. E. Johnson 20 Apr. 1985 20 p refs
(Contract DE-AC02-76CH-03000)
(DE85-014240; FNAL-TM-1315) Avail: NTIS HC A02/MF A01

A set of eight test lattices for the Superconducting Super Collider (SSC) were devised for such purposes as the investigation of the dependence of chromatic properties and dynamic aperture on the type, field, physical aperture and errors of the magnets, on the sextupole correction scheme, on the tunes and on the cell phase advances. They are distinguished from realistic lattices in that certain features of the latter are missing - most notably the crossing magnets that bring the two counter-rotating proton beams into collision at the interaction points, nd the utility insertions, which are the sites for the injection, beam abort, and radiofrequency systems. Furthermore the placement of magnets in the cells is simplified. DOE

N86-12099# Oak Ridge National Lab., Tenn.
SPHERICAL TORUS: AN APPROACH TO COMPACT FUSION AT LOW FIELD. INITIAL IGNITION ASSESSMENTS
Y. K. M. Peng, D. J. Strickler, S. K. Borowski, W. R. Hamilton, R. L. Reid, J. R. Haines, V. D. Lee, G. E. Gorker, S. S. Kalsi, and B. W. Riemer 1985 7 p Presented at the 6th Topical Meeting on the Technol. of Fusion Energy, San Francisco, 3 Mar. 1985 Prepared in cooperation with McDonnel Douglas Astronautics Co., Huntington Beach, Calif., Florida Univ., Gainesville and Tennessee

Univ., Knoxville
(Contract DE-AC05-84OR-21400)
(DE85-012890; CONF-850310-108) Avail: NTIS HC A02/MF A01

Initial assessments of ignition devices based on the spherical torus concept suggest that an ignition spherical torus (IST) can be highly cost-effective and exceptionally small in unit size. Assuming advanced methods of current drive and confinement and beta scalings with plasma current, a D-T IST with a toroidal field of 2 to 3 T is estimated to have a major radius ranging from 1 m to 1.6 m, and a fusion power less than 60 MW. For the nominal IST (at 2 T and 1.6 m), the direst cost of the nuclear island is estimated to be about $120 M with a total direct cost about $340 M in mid-1984 dollars based on the Fusion Engineering Design Center (FEDC) cost algorithm. For ISTs with higher field and smaller size (e.g., at 3 T and 1 m), further reductions of the cost of the nuclear island are estimated. In case of confinement scaling with the plasma size only, strong plasma paramagnetism (self-generated magnetic field) in the spherical torus may still serve to compensate for the projected confinement shortfall. DOE

N86-12100# Stanford Linear Accelerator Center, Calif.
VERY HIGH ENERGY COLLIDERS
B. Richter May 1985 6 p Presented at the Particle Accelerator Conf., Vancouver, British Columbia, 13 May 1985
(Contract DE-AC03-76SF-00515)
(DE85-013075; SU-SLAC-PUB-3669; CONF-850504-136) Avail: NTIS HC A02/MF A01

The required emittance in very high energy machines are small. It will be a real challenge to produce these small emittances and to maintain them during acceleration. The small emittances probably make acceleration by laser techniques easier, if such techniques will be practical at all. The beam spot sizes are very small indeed. It will be a challenge to design beam transport systems with the necessary freedom from aberration required for these small spot sizes. It would of course help if the beta functions at the collision points could be reduced. Beam power will be large - to paraphrase the old saying, power is money - and efficient acceleration systems will be required. DOE

N86-12101# National Bureau of Standards, Washington, D.C. Fracture and Deformation Div.
MATERIALS STUDIES FOR MAGNETIC FUSION ENERGY APPLICATIONS AT LOW TEMPERATURES. 7: TECHNICAL REPORTS
R. P. Reed, ed. May 1985 332 p
(DE85-014518; NBSIR-85-3025-7) Avail: NTIS HC A15/MF A01

Results of a research program to produce material property data that will facilitate design and development of cryogenic structures for the superconducting magnets of magnetic fusion energy power plants and prototypes are presented. Research results for 1984 are summarized. The technical papers are presented under four headings reflecting the main program areas: Welding, Nonmetallics, Structural Alloys, and Technology Transfer. Objectives, approaches, and achievements are summarized in an introduction to each program area. DOE

N86-12102# City Univ. of New York, Staten Island.
NON-GEOMETRICAL OPTICS INVESTIGATION OF MODE CONVERSION IN WEAKLY RELATIVISTIC INHOMOGENOUS PLASMAS
K. Imre Jun. 1985 9 p
(Contract DE-AC02-83ER-53162)
(DE85-013480; DOE/ER-53162/6) Avail: NTIS HC A02/MF A01

Electron cyclotron resonance heating of plasmas by waves incident to the fundamental and second harmonic layer was investigated. When the wave propagation is nearly perpendicular to the equilibrium field in a weakly inhomogeneous plasma the standard geometrical optics breaks down and the relativistic corrections become significant at the resonance layer. Unlike the previous studies of this problem, the governing equations are derived from the linearized relativistic Vlasov equation coupled with Maxwell's equations, rather than using the uniform field dispersion relation to construct equations by replacing the refractive index by some spatial differential operations. A boundary layer analysis is employed at the resonance region and the inner and outer solutions are matched in the usual manner. The full wave solution of the problem, and also the set of physical parameters and their ranges in which the analysis is valid were obtained. DOE

N86-12103# Sandia Labs., Albuquerque, N. Mex.
PHOTON DIAGNOSTICS LEADING TO AN IMPROVED MARX
G. J. Lockwood, L. E. Ruggles, B. T. Neyer, and L. X. Schneider 1985 8 p Presented at 5th IEEE Pulsed Power Conf., Washington, D.C., 10 Jun. 1985
(Contract DE-AC04-76DP-00789)
(DE85-013434; SAND-84-2418C) Avail: NTIS HC A02/MF A01

Utilizing the High Speed Multi-Channel Data Recorder (HS-MCDR) developed at Sandia National Laboratories, the erection pattern of a 3.2 MV particle beam fusion accelerator (PBFA) I Marx were measured. This has allowed the study variations of the erection pattern caused by changing resistors within the Marx. The effect of each resistor change was determined by monitoring the optical signal associated with switch closure using fiber optic links and the HSMCDR. Using this photonic technique, modifications that have reduced the Marx jitter by a factor of two were carried out. DOE

N86-12104# California Univ., Berkeley. Lawrence Berkeley Lab.
BEAM POSITION MONITOR FOR STORAGE RINGS
M. Nakamura and J. A. Hinkson May 1985 5 p refs Presented at Particle Accelerator Conf., Vancouver, British Columbia, 13 May 1985
(Contract DE-AC03-76SF-00098)
(DE85-013295; LBL-19554; CONF-850504-179) Avail: NTIS HC A02/MF A01

Beam position monitors (BPM) for synchrotron light storage rings usually consist of beam pickup electrodes, coaxial relays and a narrowband receiver. While accurate, these systems are slow and of limited use in the commissioning of an accelerator. A beam position monitor is described which is intended to be a principal diagnostic during debug and routine running of a storage ring. It is capable of measuring the position of a single bunch on the first or nth orbit to an accuracy of a few percent. Stored beam position is more accurately measured with averaging techniques. Beam position changes can be studied in a bandwidth from DC to a few MHz. The beam monitor electronics consist of a separate amplification, detection, and sampling channel for each beam pickup electrode. Fast switches in each channel permit selection of the nth turn for measurement (single bunch mode). A calibration pulse is injected into each channel after beam measurement to permit gain offsets to be measured and removed from the final data. While initially more costly than the usual beam position monitor system, this system will pay for itself in reduced storage ring debug and trouble shooting time. DOE

N86-12105# Fermi National Accelerator Lab., Batavia, Ill.
USING THE TEVATRON BEAM POSITION MONITOR SYSTEM TO INVESTIGATE TRANSVERSE PHASE SPACE
F. Willeke May 1985 19 p
(Contract DE-AC02-76CH-03000)
(DE85-014261; FNAL-TM-1309) Avail: NTIS HC A02/MF A01

Transverse phase space trajectories can be measured by the TEVATRON beam position monitor in the standard turn by turn operation mode if a coherent betratron oscillation is excited by a dipole kick. The measurement of phase space coordinates is influenced by incoherent and coherent synchrotron oscillations and incoherent betatron oscillations. To investigate phase space trajectories, all these effects must be understood quantitatively and if possible the measured data must be corrected. The measuring and correction procedures are investigated and the first measurements are discussed. DOE

N86-12106# Los Alamos Scientific Lab., N. Mex.
SUPERCONDUCTING MAGNETIC ENERGY STORAGE (SMES) PROGRAM Progress Report, 1 Jan. - 31 Dec. 1984

J. D. Rogers, comp. May 1985 21 p
(Contract W-7405-eng-36)
(DE85-014250; LA-10399-PR) Avail: NTIS HC A02/MF A01

The 30 MJ, 10 MW superconducting magnetic energy storage (SMES) system was devised to interact in the Western US Power System as an alternate means to damp unstable oscillations at 0.35 Hz on the Pacific HVAC Interites. The operating limits of the 30 MJ SMES unit were established, and different means of controlling real and reactive power were tested. The unit can follow a sinusoidal power demand signal with an amplitude of up to 8.6 MW with the converter working in a 12 pulse mode. When the converter operates in the constant VAR mode, a time varying real power demand signal of up to 5 MW can be met. It was shown that the Pacific ac Interite has current and reactive power variations of the same frequency as the modulating frequency of the SMES device. The reliability of the SMES subsystems with a narrow band noise input was assessed. Parameters of the ac power system were determined. Converter short circuit tests, load tests under various control conditions, dc breaker tests for coil current interruption, and converter failure mode tests were conducted. The experimental operation of the SMES system is concluded. DOE

N86-12107# Science Research Corp., Somerville, Mass.
ELECTRON BEAM POTENTIAL DIAGNOSTIC FOR TANDEM MIRRORS, PHASE 1 Final Technical Report
Apr. 1985 71 p
(Contract DE-AC02-84ER-80187)
(DE85-013515; DOE/ER-80187/1) Avail: NTIS HC A04/MF A01

The results of the Phase 1 research effort indicate that an electron beam potential diagnostic, suitable for use on the TMX-U or TARA tandem mirror experiments, would be capable of the following performance parameters: (1) accuracy of central cell potential measurement: < 200 to 500 eV, (2) time resolution 1 to 5 msec, (3) probing electron beam energy: 5 keV, (4) radial spatial resolution: 1 cm, and (5) axial spatial resolution: 1 to 5 meters. The potential measurement accuracy, time resolution and spatial resolution are interrelated, and depend on the background plasma density. These calculated performance parameters assume an X-ray flux produced by bremsstrahlung alone. Other X-ray production processes (e.g., recombination) which contribute to the X-ray production from the probing e-beam, will improve the performance of the EBPD. DOE

N86-12108# California Univ., Livermore. Lawrence Livermore Lab.
MULTIVARIABLE CURRENT CONTROL FOR ELECTRICALLY AND MAGNETICALLY COUPLED SUPERCONDUCTING MAGNETS, REVISION 1
E. W. Owen and D. W. Shimer 8 Feb. 1985 7 p Presented at the 6th Topical Meeting. on the Technol. of Fusion Energy, San Francisco, 3 Mar. 1985
(Contract W-7405-eng-48)
(DE85-012943; UCRL-92092-Rev-1; CONF-850310-113-Rev-1) Avail: NTIS HC A02/MF A01

Superconducting magnet systems under construction and projected for the future contain magnets that are magnetically coupled and electrically connected with shared power supplies. A change in one power supply voltage affects all of the magnet currents. A current controller for these system must be designed as a multivariable system. A method, based on decoupling control is described for the rational design of these systems. Dynamic decoupling is achieved by cross-feedback of the measured currents. A network of gains at the input decouples the system statically and eliminates the steady-state error. Errors are then due to component variations. The method was applied to the magnet system of the mirror fusion test facility B (MFTF-B) at the Lawrence Livermore National Laboratory. DOE

N86-12109# Sandia Labs., Albuquerque, N. Mex.
XUV PREIONIZATION EFFECTS IN HIGH POWER MAGNETICALLY INSULATED DIODES
J. Maenchen, J. R. Woodworth, B. W. Foltz, E. J. T. Burns, D. B. Seidel, L. R. Dorrell, P. R. Johnson, P. Reyes, G. Torres, and G. Williams 1985 5 p Presented at the 5th IEEE Pulsed Power Conf., Washington, D.C., 10 Jun. 1985
(Contract DE-AC04-76DP-00789)
(DE85-013142; SAND-84-2447C; CONF-850616-33) Avail: NTIS HC A02/MF A01

Electrode surface desorption and photoionization by an intense XUV pulse was shown to dramatically improve a vacuum diode impedance history. The 6-Terawatt Applied-B ion diode experiment on PBFA I is limited by a delay in both diode and ion current initiation. The insulation magnetic field impedes electron crossings which aid the ion source initiation. The diode is initially a severe overmatch to the accelerator 40-nsec, 2.2-MV, 0.5-ohm pulse. The diode current increases during the pulse, leading to a rapidly falling impedance history. The application of an intense XUV flux from an array of sixteen 60-kA spark sources is found to cause immediate diode current flow, resulting in both a greatly improved impedance history and the prompt initiation of an intense higher power ion beam. DOE

N86-12110# GA Technologies, Inc., San Diego, Calif.
ENERGY CONFINEMENT EXPERIMENTS ON DOUBLET 3 WITH HIGH POWER NEUTRAL BEAM HEATING
J. C. DeBoo and R. J. Groebner May 1985 5 p Presented at the 12th European Conf. on Controlled Fusion and Plasma Phys., Budapest, 2 Sep. 1985
(Contract DE-AC03-84ER-51044)
(DE85-014324; GA-A-18033; CONF-850927-4) Avail: NTIS HC A02/MF A01

Energy confinement experiments with up to 8 MW of both hydrogen and deuterium neutral beam power were performed in deuterium plasmas with limiter and expand boundary divertor configurations. The results of NBI-dominated experiments indicated that total stored energy W sub t and energy confinement time tau sub e had little or no variation with electron density anti n sub e and toroidal field B sub T and scaled linearly with plasma current I sub p. Previous studies in limiter discharges indicated a weak dependence on plasma elongation kappa. The confinement time dependence on elongation was not determined for divertor discharges, but assuming a dependence similar to that for limiter discharges both limiter and divertor data were consistent with W sub t and tau sub e proportional to I sub p (RADICAL)kappa. The variation of plasma stored energy with neutral beam power was consistent with a linear relationship. The linear equation describing this relationship had a non-zero intercept which illustrated the fact that energy confinement time deteriorated with neutral beam power. The energy confinement time appears to be approaching an asymptotic value at high power, consistent with a linear functional form for stored energy. However, a power law functional form for stored energy and energy confinement time can not be ruled out. DOE

N86-12111# Texas Univ., Austin. Inst. for Fusion Studies.
ENERGY CONFINEMENT IN A HIGH-CURRENT REVERSED FIELD PINCH
Z. G. An, G. S. Lee, and P. H. Diamond Jul. 1985 11 p Presented at the 7th US Symp. on Compact Toroid Res., Santa Fe, N. Mex., 21 May 1085
(Contract DE-FG05-80ET-53088)
(DE85-015009; DOE/ET-53088/196; IFSR-196; CONF-8505100-17) Avail: NTIS HC A02/MF A01

The ion temperature gradient driven (eta sub i) mode is proposed as a candidate for the cause of anomalous transport in high current reversed field pinches. A four-field fluid model is derived to describe the coupled nonlinear evolution of resistive interchange and eta sub i modes. A renormalized theory is discussed, and the saturation level of the fluctuations is analytically estimated. Transport scalings are obtained, and their implications discussed. In particular, these results indicate that pullet injection is a potentially viable mechanism for improving energy confinement in a high temperature reverse field pinch (RFP). DOE

N86-12112# California Univ., Berkeley. Electronics Research Lab.
SIMULATION OF QUIET START MAGNETIZED PLASMAS, INCLUDING MAXWELLIAN AND VELOCITY-SPACE RING DISTRIBUTIONS
K. P. Kenyon 27 Jul. 1985 32 p
(Contract DE-AT03-76ET-53064)
(DE85-014394; DOE/ET-53064/T5) Avail: NTIS HC A03/MF A01

Longitudinal electrostatic waves are simulated in a magnetized plasma, propagating perpendicular to B0. Groups of particles are arranged in one or more rings and spokes in velocity space. Using various loading schemes to represent different particle velocity-space distributions in the simulations of (upsilon sub perpendicular), these particles are then distributed uniformly in position space along the length of the system. In particular, the evolution of magnetized cold and warm rings is followed (physically unstable), and of a magnetized Maxwellian (unstable due to the particle loading) through to saturation. Rules are deduced for useful loading methods. DOE

N86-12113# California Univ., Berkeley. Electronics Research Lab.
PARTICLE SIMULATION OF THE LOW-(ALPHA) PIERCE DIODE
T. L. Crystal and S. Kuhn 20 Sep. 1984 42 p
(Contract DE-AT03-76ET-53064)
(DE85-014435; DOE/ET-53064/T3) Avail: NTIS HC A03/MF A01

The evolution of small initial perturbations of the uniform equilibrium of the classical Pierce diode is studied using particle simulations. These simulations were performed with the new bounded plasma code PDW1 and cover the parameter range 0 < (ALPHA) < 3 (PI), where (ALPHA) = (LC OMEGA)/sub p.L/v0. In the linear regime, three stages (initial-transit, adjustment, and dominant-eigenmode) are distinguished; oscillation frequencies, growth/damping rates, and potential profiles of the dominant eigenmode as well as oscillation frequencies of the next-to-dominant eigenmode are recovered and shown to agree quantitatively with recent analytical results. In the linearly unstable cases, the system evolves nonlinearly to a final state which may be either a new, nonuniform dc equilibrium, or a state of large-amplitude oscillations. In particular, for (ALPHA) = 1.5(PI) the character of the final state is found to depend on the details of the initial conditions. DOE

N86-12114# California Univ., Livermore. Lawrence Livermore Lab.
NEW CONCEPTS FOR DRIFT PUMPING A THERMAL BARRIER WITH RF
J. D. Barter, D. Baldwin, Y. Chen, and P. Poulsen 9 May 1985 8 p Presented at the 6th Topical Conf. on Radio Frequency Plasma Heating, Pine Mountain, Ga., 13 May 1985 Prepared in cooperation with TRW Systems, Redondo Beach, Calif.
(Contract W-7405-eng-48)
(DE85-013591; UCRL-92643; CONF-8505130-6) Avail: NTIS HC A02/MF A01

Pump neutral beams, which are directed into the loss cone of the TMX-U plugs, are normally used to pump ions from the thermal barriers. These neutral beams introduce cold gas that reduces pumping efficiency, require a straight line entrance and exit from the plug. Alternate methods are investigated to provide barrier pumping. To maintain the thermal barrier, either of two classes of particles can be pumped. First, the collisionally trapped ions can be pumped directly. The most promising selection criterion is the azimuthal drift frequency. Second, the excess sloshing-ion density can be removed, allowing the use of increased sloshing-beam density to pump the trapped ions. The selection mechanism is the Doppler-shifted ion-cyclotron resonance of the high-energy sloshing-ions. DOE

N86-12115# Sandia Labs., Albuquerque, N. Mex.
RIMFIRE: A SIX MEGAVOLT LASER-TRIGGERED GAS-FILLED SWITCH FOR PBFA 2
D. R. Humphreys, K. J. Penn, J. S. Cap, R. G. Adams, J. F. Seamen, and B. N. Turman 1985 5 p Presented at the 5th IEEE Pulsed Power Conf., Washington, D.C., 10 Jun. 1985
(Contract DE-AC04-76DP-00789)
(DE85-013959; SAND-84-2505C; CONF-850616-62) Avail: NTIS HC A02/MF A01

A new multiple stage laser-triggered SF6 spark gap was developed, which performed well in tests at nearly 6 megavolts and half a megampere. It has survived many hundreds of shots between 5 and 5.7 MV. A 25 millijoule ultraviolet laser pulse arriving in its trigger gap reliably closes the whole switch in 20 nanoseconds with 0.4 ns 1-sigma jitter. The closing time has a low dependence on the applied voltage, about 0.9 ns/% of self-break voltage. For a 10 mJ laser pulse, the jitter is 1.5 ns and the slope is 1.0 ns/%. No prefires occurred; the estimated prefire rate at 90% of self-breaking voltage is less than 0.1%. The switch inductance is 400 nanohenries, of which about 100 nh comes from the spark channels. The switch is 68 cm long and 61 cm in diameter. DOE

N86-12116# Sandia Labs., Albuquerque, N. Mex.
PBFA 2: A 100 TW PULSED POWER DRIVER FOR THE INERTIAL CONFINEMENT FUSION PROGRAM
B. N. Turman, T. H. Martin, E. L. Neau, D. R. Humphreys, D. D. Bloomquist, D. L. Cook, S. A. Goldstein, L. X. Schneider, D. H. McDaniel, and J. M. Wilson 1985 8 p Presented at the 5th IEEE Pulsed Power Conf., Washington, D.C., 10 Jun. 1985
(Contract DE-AC04-76DP-00789)
(DE85-013956; SAND-84-2524C; CONF-850616-61) Avail: NTIS HC A02/MF A01

The 100 TW Particle Beam Fusion Accelerator (PBFA II) is well into the procurement and assembly phases, with the first shot scheduled for January 1986. Installation of several major sub-assemblies is underway. The PBFA II output will drive a fast opening switch in the vacuum insulator stack, providing a 30 MV, 15 ns output pulse, which accelerates lithium ions. The ions will focus onto a pellet containing deuterium-tritium, producing fusion energy. Several research areas will be reviewed: low jitter, highly reliable 370 kJ Marx generators; highly synchronized gas switching at 5 MV; efficient water switch operation of 5 MV lines; series-parallel arrangements for increasing voltage or current; and plasma erosion opening switches. DOE

N86-12117# Brookhaven National Lab., Upton, N. Y.
PHYSICS OPPORTUNITIES WITH RELATIVISTIC HEAVY ION ACCELERATORS
N. P. Samios 1985 4 p Presented at the Particle Accelerator Conf., Vancouver, British Columbia, 13 May 1985
(Contract DE-AC02-76CH-00016)
(DE85-014190; BNL-36735; CONF-850504-194) Avail: NTIS HC A02/MF A01

The physics motivation for a relativistic heavy ion collider with energies of 100 GeV/amu x 100 GeV/amu for nuclei of A-200 are: (1) this will allow the production in the laboratory of a new state of matter - the quark gluon plasma, (2) the study of such interactions will provide an experimental test of statistical quantum chromodynamics (QCD), i.e., a look at the properties of the QCD vacuum at large distances, (3) such reactions will simulate the conditions of the early universe, and (4) such a collider will allow us to delve into the unknown. If history is any guide then it is clear that any time one can increase an important physics parameter by a factor of 10 (and in this case a factor of 100 over what is presently being done) then do it. At present the Bevalac at Berkeley is the premier facility for the study of heavy ions with a center of mass capability of 1 GeV/amu x 1 GeV/amu. In the near term this capability will be increased at the AGS at BNL (6 GeV/amu x 6 GeV/amu) and at the CERN SPS (10 GeV/amu x 10 GeV/amu). DOE

N86-12118# Stanford Linear Accelerator Center, Calif.
HIGHER LUMINOSITIES VIA ALTERNATIVE INCIDENT CHANNELS
J. E. Spencer Apr. 1985 13 p refs Presented at the PEP High

Luminosity Workshop, Stanford, Calif., 5 Apr. 1985
(Contract DE-AC03-76SF-00515)
(DE85-014355; SU-SLAC-PUB-3645; CONF-8504155-3) Avail: NTIS HC A02/MF A01

We show that PEP provides some unique opportunities for one and two photon physics with real photons as well as for QCD studies with internal targets. Photon beams would avoid the major limitation on the luminosity of present machines and could provide PEP an ideal b-physics factory producing the full range of J/sub c//sup PC/ and J/sub b//sup PC/ states that may not be observable otherwise as well as allow a whole new class of missing-mass experiments. These latter particles are the pseudo-Goldstone bosons and their supersymmetric counterparts. These and related possibilities like a single-pass, free electron laser facility or even synchrotron radiation beam lines all favor a mini-maxi configuration for the low-beta insertions in PEP. This allows more diverse experiments without excluding any ongoing experimental programs. Such possibilities have interesting implications for a number of proposed facilities including the SSC. Some systematic machine physics studies over a range of energies are suggested. DOE

N86-12119# Sandia Labs., Albuquerque, N. Mex.
COMPARISON OF ENERGY TRANSPORT MEASUREMENTS AND COMPUTER SIMULATIONS IN A SINGLE MODULE PROTOTYPE FOR PBFA 2
E. L. Neau, J. F. Seamen, D. D. Bloomquist, S. R. Babcock, L. X. Schneider, and B. R. Sujka 1985 5 p Presented at the 5th IEEE Pulsed Power Conf., Washington, D.C., 10 Jun. 1985
(Contract DE-AC04-76DP-00789)
(DE85-013960; SAND-84-2584C; CONF-850616-63) Avail: NTIS HC A02/MF A01

The 36-module Particle Beam Fusion Accelerator (PBFA II) is designed to provide a 30 MV pulse, with greater than 150 TW, to a centrally located lithium ion diode. Each module is driven by a 6 MV, 400 kJ Marx generator and uses three water-insulated and switched pulse compression stages followed by a voltage inversion-adder unit. All impedance matching transmissioin-line transformer couples the output pulse from the inversion-adder unit to the central vacuum insulator, plasma erosion switches, and ion diode. The prototype of a single PBFA-II module, called Demon, is being used to test component design, including a mock-up of a section of the vacuum insulator, and to determine overall module operating characteristics. The results of measurements of energy transport efficiencies through the successive pulse compression stages are presented. Results of energy transport measurements on an 18 module, one-fifth scale model, are also compared to the single-line data. A comparison of measured parameters with computer circuit code simulations of the hardware design is also included. Comparisons are used to suggest areas of possible improvements. The measured module output characteristics agree with the code simulations and meet the design requirements for the PBFA-II accelerator. DOE

N86-12120# California Univ., Livermore. Lawrence Livermore Lab.
INTERACTION OF THE ATA BEAM WITH THE TM030 MODE OF THE ACCELERATING CELLS
V. K. Neil 14 Feb. 1985 11 p
(Contract W-7405-eng-48)
(DE85-014850; UCID-20456) Avail: NTIS HC A02/MF A01

The interaction of the electron beam in the Advanced Test Accelerator with azimuthally symmetric mode of the accelerating cells is investigated theoretically. The interaction possibly could cause modulation of the beam current at the resonant frequency of the mode. Values of the shunt impedance and Q value of the mode were obtained from previous measurement and analysis. Lagrangian hydrodynamics is employed and a WKB solution to the equation of motion is obtained. Results indicate that the interaction will not be a problem in the accelerator. DOE

N86-12121# Sandia Labs., Albuquerque, N. Mex.
MABE MULTIBEAM ACCELERATOR
D. E. Hasti, J. J. Ramirez, P. D. Coleman, C. W. Huddle, A. W. Sharpe, and L. I. Torrison 1985 15 p refs Presented at the 5th IEEE Pulsed Power Conf., Washington, D.C., 10 Jun. 1985
(Contract DE-AC04-76DP-00789)
(DE85-012035; SAND-84-2393C; CONF-850616-59) Avail: NTIS HC A02/MF A01

The Megamp accelerator and beam experiment (MABE) was the technology development testbed for the multiple beam, linear induction accelerator approach for Hermes III, a new 20 MeV, 0.8 MA, 40 ns accelerator under development for gamma ray simulation. Experimental studies of a high current, single beam accelerator, and a nine beam injector were completed, and experiments on a nine beam linear induction accelerator are in progress. A two beam linear induction accelerator is designed and will be built as a gamma ray simulator to be used in parallel with Hermes III. The MABE pulsed power system and accelerator for the multiple beam experiments is described. Results from these experiments and the two beam design are discussed. DOE

N86-12122# Los Alamos Scientific Lab., N. Mex.
REVIEW OF KAON FACTORY PROPOSALS
H. A. Thiessen 1985 7 p refs Presented at the Particle Accelerator Conf., Vancouver, British Columbia, 13 May 1985
(Contract W-7405-eng-36)
(DE85-014110; LA-UR-85-2081; CONF-850504-204) Avail: NTIS HC A02/MF A01

Nuclear physics issues and particle physics issues for a kaon factory are discussed. Kaon factory accelerator proposals are considered. Secondary beam considerations are covered and hardware development for a kaon factory is discussed. The prospects for construction are presented. DOE

N86-12123# Sandia Labs., Albuquerque, N. Mex.
LOW INDUCTANCE DIODE DESIGN OF THE PROTO 2 ACCELERATOR FOR IMPLODING PLASMA LOADS
W. W. Hsing, R. Coats, D. H. McDaniel, and R. B. Spielman 1985 5 p Presented at the 5th IEEE Pulsed Power Conf., Washington, D.C., 10 Jun. 1985
(Contract DE-AC04-76DP-00789)
(DE85-013783; SAND-84-2568C; CONF-850616-53) Avail: NTIS HC A02/MF A01

A new water transmission line convolute, single piece insulator, and double accelerator. The water transmission lines have a 5 cm gap to eliminate any water arcing. A two-dimensional magnetic field code was used to calculate the convolute inductance. An acrylic insulator was used as well as a single piece, laminated polycarbonate insulator. They have been successfully tested at over 90% of the Shipman criteria for classical insulator breakdown, although the laminations in the polycarbonate insulator failed after a few shots. The anode and cathode each have two pieces and are held together mechanically. The vacuum MITL tapers to a 3 mm minimum gap. The total inductance is 8.4 nH for gas puff loads and 7.8 nH for imploding foil loads. Out of a forward-going energy of 290 kJ, 175 kJ has been delivered past the insulator, and 100 kJ has been successfully delivered to the load. DOE

N86-12124# Stanford Linear Accelerator Center, Calif.
COUPLED VIRBRATIONAL MODES OF THE SLC ARC MAGNET AND SUPPORT SYSTEM
W. T. Weng and A. W. Chao Mar. 1985 4 p refs Presented at the Particle Accelerator Conf., Vancouver, British Columbia, 13 May 1985
(Contract DE-AC03-76SF-00515)
(DE85-014288; SU-SLAC-Pub-3607; CONF-850504-198) Avail: NTIS HC A02/MF A01

The magnet support system for the SIC Arcs will be a long series of pedestals with each pedestal supporting the ends of two adjacent magnets. It was pointed out by several authors that random magnet vibrations in the Arc with amplitudes larger than 0.1 (MU)m rms are potentially harmful for the SIC operation. In order to assess the vibrational behavior of the Arc magnet system, the following must be understood: (1) the sources and characteristics of the ground disturbances, (2) the coupled vibrational modes

of the composite pedestal-magnet system, and (3) the response of the system to ground disturbance. DOE

N86-12125# Stanford Linear Accelerator Center, Calif.
MEASUREMENTS OF ULTIMATE ACCELERATING GRADIENTS IN THE SLAC DISK-LOADED STRUCTURE
J. W. Wang and G. A. Loew Mar. 1985 4 p refs Presented at the Particle Accelerator Conf., Vancouver, British Columbia, 13 May 1985
(Contract DE-AC03-76SF-00515)
(DE85-014287; SU-SLAC-PUB-3597; CONF-850504-201) Avail: NTIS HC A02/MF A01

A status report on an on-going program at SLAC to study accelerator structures under high-gradient electric field conditions is presented. The study is a part of a much broader program dealing with future linear colliders. The accelerating gradient that might be achievable in such machines is a crucial parameter because once the beam energy is selected, the gradient determines the length of the linac and directly or indirectly affects the choice of many other parameters. To reach 1000 MV/m in a conventional 3 m constant-gradient section without SLED, one would need a klystron with a peak power output of 900 MW. Since such a tube is not available, it was decided to use a short standing-wave section in which the resonant fields can build up. The design criteria for this section, the fabrication, matching and tuning, the experimental set-up and the results are described. Author

N86-12126# Los Alamos Scientific Lab., N. Mex.
ACCELERATION SIMULATION IN THE LAMPF 2 BOOSTER
E. P. Colton 1985 4 p refs Presented at the Particle Accelerator Conf., Vancouver, British Columbia, 13 May 1985
(Contract W-7405-eng-36)
(DE85-012695; LA-UR-85-1518; CONF-850504-209) Avail: NTIS HC A02/MF A01

The evolution of the longitudinal phase space was studied during acceleration from 0.797-7.3 GeV in the LAMPF II booster. This machine is planned to multiparticle simulation program was used to model the acceleration with space charge included. The bunch population of 2.5 x 10 ti tge 11th protons was represented by 1000 macroparticles. During acceleration the rms longitudinal emittance grows by 3% and two particles are lost out of the separatrix. DOE

N86-12127# Rochester Univ., N. Y. Lab. for Laser Energetics.
OMEGA: A 24 BEAM UV IRRADIATION FACILITY
M. C. Richardson, W. Beich, J. Delettrez, M. Dunn, L. Folnsbee, R. J. Hutchinson, S. A. Jacobs, R. Keck, T. Kessler, W. Lampeter et al 1985 27 p refs Presented at Conf. on Lasers and Electro-optics, Baltimore, 21 May 1985
(Contract DE-FC08-85DP-40200)
(DE85-014416; DOE/EP-40200/8; CONF-850558-5) Avail: NTIS HC A03/MF A01

The recent completion of the UV upconversion (351 nm) of all 24 beams of the OMEGA laser which provides a unique short wavelength symmetrical irradiation facility for direct drive laser fusion experiments is discussed. Details of the characterization of illumination uniformity and initial implosion experiments are described. DOE

N86-12128# Pulse Sciences, Inc., Oakland, Calif.
MODELLING OF THE PROTO-2 CROSSOVER NETWORK
G. A. Proulx, H. Lackner, P. Spence, and T. P. Wright (Sandia Labs., Albuquerque, N. Mex.) 1985 5 p refs Presented at 5th IEEE Pulsed Power Conf., Washington, D.C., 10 Jun. 1985
(Contract DE-AC04-76DP-00789)
(DE85-014639; SAND-84-2588C; CONF-850616-69) Avail: NTIS HC A02/MF A01

In order to drive a double ring, symmetrically fed bremsstrahlung diode, the PROTO II accelerator was redesigned. The radially converging triplate water line was reconfigured to drive radial converging triplate lines in parallel. The four output lines were connected to the two input lines via an electrically enclosed tubular crossover network. Low-voltage Time Domain Reflectrometry (TDR) experiments were conducted on a full scale water immersed model of one section of the crossover network as an aid in this design. A lumped element analysis of the power flow through the network was inadequate in explaining the observed wave transmission and reflection characteristics. A more detailed analysis was performed with a circuit code in which we considered both localized lump-element and transmission line features of the crossover network. Experimental results of the model tests are given and compared with the circuit simulations. DOE

N86-12129# Texas Univ., Austin. Inst. for Fusion Studies.
VARIATIONAL QUADRATIC FORM FOR LOW FREQUENCY ELECTROMAGNETIC PERTURBATIONS. 1: FORMALISM
H. I. Berk and B. G. Iane (MIT, Cambridge) Jun. 1985 30 p refs 2 Vol.
(Contract DE-FG05-80ET-53088)
(DE85-014896; IFSR-175-1; DOE/ET-53088/175-1) Avail: NTIS HC A03/MF A01

A variational formalism is obtained in the limit of large perpendicular wavenumber which simultaneously includes electrostatic and electromagnetic perturbations, finite Larmor radius corrections, equilibrium plasma rotation and arbitrary particle bounce effects. A tractable final expression is obtained and kinetic integrals are evaluated in special limits. The more accurate non-eikonal expression is obtained from the asymptotic matching of the eikonal form to more restrictive non-eikonal quadratic forms derived elsewhere. DOE

N86-12130# California Univ., Los Angeles. Center for Plasma Physics and Fusion Engineering.
FINESSE: STUDY OF THE ISSUES, EXPERIMENTS AND FACILITIES FOR FUSION NUCLEAR TECHNOLOGY RESEARCH AND DEVELOPMENT, VOLUME 4 Interim Report
M. Abdou Oct. 1984 658 p refs
(Contract DE-AS03-84ER-52105)
(DE85-010947; UCLA-ENG-84-30-Vol-4; PGG-821-Vol-4) Avail: NTIS HC A99/MF A01

This volume contains the following chapters (1) neutronics tests, (2) fluence considerations, (3) instrumentation and test matrix, (4) non-neutron test stands, (5) accelerator-based point neutron sources, (6) utilization of fission reactors, (7) tandem mirror test facilities, (8) tokamak fusion test facilities, (9) reliability development testing impacts on fusion reactor availability, and (10) fusion development scenarios. In addition, the following appendices are included: (1) evaluation of experience from fast breeder reactors, (2) observations of experts from the fission field, (3) avaluation of experience from the aerospace industry, (4) characterization of fusion nuclear systems operating environment, (5) modelling of MFTF-(alpha)+T high gamma mode performance, and (6) small-scale, multiple effects testing at US/DOE breeder reactor in-pile facilities. DOE

N86-12131# Rochester Univ., N. Y.
WHAT EXTENT WILL SMALL-SCALE LASER-BEAM FLUCTUATIONS SEED THE RAYLEIGH-TAYLOR INSTABILITY IN DIRECT-DRIVE TARGETS
S. Skupsky, R. I. McCrory, and C. P. Verdon 1984 9 p refs Presented at Meeting of the Plasma Phys. Div. of the Am. Phys. Soc., Boston, 27 Oct. 1984
(Contract DE-AC08-80DP-40124)
(DE85-014408; DOE/DP-40124/59; CONF-841010-16) Avail: NTIS HC A02/MF A01

The nonuniformity in laser energy deposition on a spherical target is calculated for multiple overlapping beams having small-scale fluctuations. Such nonuniformities can imprint themselves on the target surface and seed the Rayleigh-Taylor instability early in the pulse before an adequate, smoothing plasma-atmosphere has been established. The resulting growth of target deformation during the implosion is estimated. DOE

N86-12132# Los Alamos Scientific Lab., N. Mex.
RECENT FRC TRANSLATION EXPERIMENTS ON FRX-C/T
D. J. Rej, W. T. Armstrong, R. E. Chrien, W. N. Hugrass, P. L.

Klingner, K. F. McKenna, E. G. Sherwood, R. E. Siemon, and M. Tuszewski 1985 6 p Presented at the 7th US Symp. on Compact Toroid Res., Santa Fe, N. Mex., 21 May 1985
(Contract DE-AC04-76DP-00789)
(DE85-012745; LA-UR-85-1788; CONF-8505100-13) Avail: NTIS HC A02/MF A01

Accomplishments in the FRC translation studies on the FRX-C/T device are presented: (1) FRCs were launched into, and trapped in, a dc magnetic guide field region without the use of any pulsed gate coils; (2) detailed studies of translation dynamics were performed which are consistent with energy conservation, adiabatic compression theory, and 2-MHD simulations; (3) the confinement properties of translated FRC was evaluated; (4) translation through either puff or static deuterium gas fill was demonstrated; (5) higher density FRCs were translated over 10-m lengths; (6) the n = 2 rotational instability is stabilized by FRC translation into a weak helical quadrupole field. DOE

N86-11919# Joint Publications Research Service, Arlington, Va.
DOUBLE TEARING MODE IN PLASMA WITH MAGNETIC BRAIDING
Jiaqi Dong *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-014) 2 May 1985 p 28-39 refs Transl. into ENGLISH from Wuli Xuebao (Beijing), v. 33, no. 10, Oct. 1984 p 1341-1349 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

N86-11932# Joint Publications Research Service, Arlington, Va.
PROGRESS OF INERTIAL CONFINEMENT FUSION (ICF) RESEARCH Abstract Only
Ganchang Wang *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-014) 2 May 1985 p 85 Transl. into ENGLISH from He Kexue Yu Gongcheng (Beijing), v. 4, no. 4, Dec. 1984 p 289-302 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

N86-11956# Joint Publications Research Service, Arlington, Va.
INITIAL PLASMA FORMATION DURING EXPOSURE OF ABSORBING MATERIALS TO LASER RADIATION WITH PLANE EXPANSION GEOMETRY OF THE FORMING PLASMA Abstract Only
L. Ya. Minko, Yu. A. Chivel, and A. N. Chumakov *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 14-15 Transl. into ENGLISH from Zh. Prikl. Spektrosk. (Minsk), v. 42, no. 1, Jan. 1985 p 55-61 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

N86-11958# Joint Publications Research Service, Arlington, Va.
INFLUENCE OF SOLID STATE OBSTACLES ON RADIATION OF RECOMBINATION LASER PLASMA Abstract Only
V. A. Boyko, B. A. Bryunetkin, F. V. Bunkin, V. I. Derzhiyev, V. M. Dyakin, S. A. Mayorov, I. Yu. Skobelev, A. Ya. Fayenov, A. I. Fedosimov, and K. A. Shilov *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 16-17 refs Transl. into ENGLISH from Fiz. Plazmy (Moscow), v. 10, no. 5, Sep. - Oct. 1984 p 999-1009 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

N86-11997# Joint Publications Research Service, Arlington, Va.
CENTER FOR HIGH TEMPERATURE PLASMA PHYSICS CERTIFIED Abstract Only
Hu Maolian *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-015) 16 May 1985 p 13-14 Transl. into ENGLISH from Anhui Ribao (Hefei), 21 Jan. 1985 p 1 (For primary document see N86-11994 02-70)
Avail: NTIS HC A07/MF A01

N86-11998# Joint Publications Research Service, Arlington, Va.
CONTROLLED THERMONUCLEAR FUSION, HIGH TEMPERATURE PLASMA PHYSICS Abstract Only
In its China Rept.: Sci. and Technol. (JPRS-CST-85-015) 16 May 1985 p 15 Transl. into ENGLISH from Anhui Ribao (Hefei), 21 Jan. 1985 p 1 (For primary document see N86-11994 02-70)
Avail: NTIS HC A07/MF A01

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N86-12133 California Inst. of Tech., Pasadena.
INVESTIGATIONS OF DEEP LEVEL DEFECTS IN SEMICONDUCTOR MATERIAL SYSTEMS Ph.D. Thesis
Arati Prabhakar 1985 132 p
Avail: Univ. Microfilms Order No. DA8508467

Deep level defects in semiconductor material systems were investigated. Background information on semiconductor impurities and deep level transient spectroscopy (DLTS) are reviewed. The experiments performed on transition metal silicide-silicon Schottky barrier structures to probe for the existence of deep levels are discussed. Platinum, palladium, and nickel silicides on n-type silicon which were annealed at temperatures from 300 to 800 C were investigated. Nickel silicide structures could only withstand temperatures up to 500 C. Cobalt, chromium, and erbium silicides were also studied using DLTS. These measurements constitute the first series of deep level contamination of the silicon underlying a transition metal silicide thin film. The DLTS studies of four different compositions of the alloy In sub 1 x Ga sub x As sub y P sub 1-y. The samples, with bandgaps of 0.75, 0.83, 0.95, and 1.1 eV, covered the range of compositions that are lattice-matched to InP and are used for long-wavelength optoelectric devices.
Author

N86-12134*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELLIPSOMETRIC AND OPTICAL STUDY OF SOME UNCOMMON INSULATOR FILMS ON 3-5 SEMICONDUCTORS
S. A. Alterovitz, J. D. Warner, D. C. Liu, and J. J. Pouch [1985] 18 p refs Presented at the 168th Meeting of the Electrochem. Soc., Las Vegas, Nev., 13-18 Oct. 1985
(NASA-TM-87135; E-2750; NAS 1.15:87135) Avail: NTIS HC A02/MF A01 CSCL 20L

Optical properties of three types of insulating films that show promise in potential applications in the 3-4 semiconductor technology were evaluated, namely a-C:H, BN and CaF2. The plasma deposited a-C:H shows an amorphous behavior with optical energy gaps of approximately 2 to 2.4 eV. These a-C:H films have higher density and/or hardness, higher refractive index and lower optical energy gaps with increasing energy of the particles in the plasma, while the density of states remains unchanged. These results are in agreement, and give a fine-tuned positive confirmation to an existing conjecture on the nature of a-C:H films (1). Ion beam deposited BN films show amorphous behavior with energy gap of 5 eV. These films are nonstoichiometric (B/N approximately 2) and have refractive index, density and/or hardness which are dependent on the deposition conditions. The epitaxially grown CaF2 on GaAs films have optical parameters equal to bulk, but evidence of damage was found in the GaAs at the interface. Author

N86-12135*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CARBON FILMS GROWN FROM PLASMA ON III-V SEMICONDUCTORS
J. J. Pouch, J. D. Warner, and D. C. Liu 1985 12 p refs Presented at the 168th Meeting of the Electrochem. Soc., Las Vegas, Nev., 11-17 Oct. 1985
(NASA-TM-87140; E-2766; NAS 1.15:87140) Avail: NTIS HC A02/MF A01 CSCL 09C

Dielectric carbon films were grown on n- and p-type GaAs and InP substrates using plasmas generated at 30 KHz from gaseous hydrocarbons. The effect of gas source, flow rate, and power on film growth were investigated. Methane and n-butane

gases were utilized. The flow rate and power ranged from 30 to 50 sccm and 25 to 300 W, respectively. AES measurements show only carbon to be present in the films. The relative Ar ion sputtering rate (3 KeV) of carbon depends on the ratio power/pressure. In addition, the degree of asymmetry associated with the carbon-semiconductor interface is approximately power-independent. SIMS spectra indicate different H-C bonding configurations to be present in the films. Band gaps as high as 3.05 eV are obtained from optical absorption studies. Author

N86-12136# California Univ., Los Angeles. Dept. of Chemistry and Biochemistry.
FRACTAL-LIKE, BUT NON-FRACTAL, BEHAVIOR OF ONE STEP DIPOLAR ENERGY TRANSFER ON REGULAR LATTICES WITH EXCLUDED VOLUME Interim Technical Report
C. L. Yang, P. Evesque, and M. A. El-Sayed 24 Jul. 1985 19 p
(Contract N00014-83-K-0341)
(AD-A157382; TR-45) Avail: NTIS HC A02/MF A01 CSCL 11/2

A simulation calculation is carried out for the time dependence of the donor intensity as one-step acceptor trapping process on a simple cubic lattice of interconnected rods of dimensions comparable to those found for the pores of Vycor (Corning Glass 7930). The donor and acceptor are allowed to occupy random sites on the surface of the pore. The results are fitted using the equations of Blumen and Klafter for energy transfer on a fractal structure. An apparent fractal dimension, (d'), is determined which is shown to result from an excluded volume effect and is not due to a real fractal structure. (D') is found to depend slightly on time, the acceptor concentration, and the length and/or width of the pores. Author (GRA)

N86-12137# Arizona Univ., Tucson. Optical Sciences Center.
THIN FILM RESEARCH. VOLUME 1 Final Report, 8 Jan. 1981 - 31 Jul. 1984
H. A. MacLeod 30 May 1985 492 p
(Contract N60530-81-C-0158; ARPA Order 3343)
(AD-A157608) Avail: NTIS HC A21/MF A01 CSCL 07/4

Optical thin films are critical components in a broad range of technologies, ranging from energy conversion to information storage. In response to the demand for increasingly specialized and durable coatings, enquiry into the basic nature of these coatings has intensified. Such efforts are necessary because assumptions that thin films were similar to nominally identical bulk materials have proven unreliable. For example, while most bulk materials show a high degree of isotropy, thin films display pronounced anisotropy. Another distinction between bulk and thin film materials is the lower density of the latter, with the resulting porosity. Both anisotropy and porosity often contribute to the unpredictable performance and durability of optical coatings. This report covers three years of fruitful research aimed at better understanding and modifying film microstructure in the direction of greater isotropy and density through novel deposition techniques. We have supported this effort with an array of analysis techniques and with a major effort in film growth simulation and in the theoretical description of anisotropic films. GRA

N86-12138# Arizona Univ., Tucson. Optical Sciences Center.
THIN FILM RESEARCH. VOLUME 2 Final Report, 8 Jan. 1981 - 31 Jul. 1984
H. A. MacLeod 30 May 1985 391 p
(Contract N60530-81-C-0158; ARPA Order 3343)
(AD-A157609) Avail: NTIS HC A17/MF A01 CSCL 07/4

Optical thin films are important components in a range of technologies, ranging from energy conversion to information storage. In response to the demand for increasingly specialized and durable coatings, study of the basic nature of these coatings has intensified. This type of effort is necessary because assumptions that thin films were similar to nominally identical bulk materials have proven unreliable. While most bulk materials show a high degree of isotropy, thin films display pronounced anisotropy. Another distinction between bulk and thin film materials is the lower density of the latter, with the resulting porosity. Both anisotropy and porosity often contribute to the unpredictable performance and durability of optical coatings. Three years of sucessful research aimed at better understanding and modifying film microstructure in the direction of greater isotropy and density through novel deposition techniques are covered in this report. We have supported this effort with a wide range of analysis techniques and with a major effort in film growth simulation and in the theoretical description of anisotropic films. GRA

N86-12139# Midwest Research Inst., Golden, Colo.
INVESTIGATION OF DEFECTS IN GaAsP SUPERLATTICE STRUCTURES
M. M. Al-Jassim and K. M. Jones Jun. 1985 7 p Presented at the 4th Oxford Conf. on Microscopy of Semiconducting Mater., Oxford, 25 Mar. 1985
(Contract DE-AC02-83CH-10098)
(DE85-012134; SERI/TP-212-2753; CONF-8503131-3) Avail: NTIS HC A02/MF A01

GaAsP superlattices were incorporated in GaAs/GaAsP cascade solar cell structures in an attempt to reduce the dislocation density in the high band gap cell. The structures were grown on GaAs substrates by MOCVD. Defects and irregularities in these structures were investigated by TEM, EBIC, X-ray microanalysis and chemical etching. DOE

N86-12140# Sandia Labs., Albuquerque, N. Mex.
ANALYTICAL ELECTRON MICROSCOPY STUDY OF SHOCK SYNTHESIZED ZINC FERRITE
M. J. Carr and R. A. Graham 1985 6 p Presented at the Am. Phys. Soc. Topical Conf. on Shock Waves in Condensed Matter, Spokane, 22 Jul. 1985
(Contract DE-AC04-76DP-00789)
(DE85-015144; SAND-85-1514C; CONF-850736-32) Avail: NTIS HC A02/MF A01

Mixtures of zinc oxide and hematite were shock loaded to various conditions, some of which resulted in the formation of zinc ferrite. Selected samples of reacted and unreacted mixtures were examined for the presence of zinc ferrite. Shock synthesized ferrite, having the spinel crystal structure, was found to occur as recrystallized regions within a heavily deformed matrix of well mixed reactants. The synthesized ferrite was not stoichiometric, but rather was found to be Zn/sub 1-x/Fe/sub 2+x/O4, where x = 0.09 + or - 0.02. DOE

N86-12141# Arizona Univ., Tucson.
METALLIC MULTILAYERS AND SUPERLATTICES
C. M. Falco 1985 11 p Presented at the 5th European Soc. General Conf. of Condensed Matter Div., West Berlin, 18 Mar. 1985
(Contract DE-AC02-83ER-45025)
(DE85-014444; DOE/ER-45025/7; CONF-8503152-1) Avail: NTIS HC A02/MF A01

An introduction to metal-metal multilayers and superlattices is presented, along with a brief review of some of the materials which have been made in our lab, and phenomena which have been observed so far. Results of a number of X-ray structural characterization techniques applied to these materials are described. These include Bragg THETA-2THETA X-ray diffraction, transmission and reflection Laue diffraction, and wide-film Debye-Scherrer diffraction. Emphasis is placed on recent results obtained in our laboratory with multilayers and superlattices produced by sputtering techniques. DOE

N86-12142# Southwest Research Inst., San Antonio, Tex.
SANDIA SHOCK COMPRESSION DATABASE
C. E. Anderson, J. S. Wilbeck, J. C. Hokanson, J. R. Asay, D. E. Grady, R. A. Graham, and M. E. Kipp 1985 11 p Presented at the Am. Phys. Soc. Top. Conf. on Shock Waves in Condensed Matter, Spokane, 22 Jul. 1985 Prepared in cooperation with Sandia National Lab., Albuquerque, N. Mex.
(Contract DE-AC04-76DP-00789)
(DE85-015141; SAND-85-0308C; CONF-850736-29) Avail: NTIS HC A02/MF A01

An authoritative, updatable, and searchable bibliographic database whose topical area is shock compression is currently under development. The database is derived from published scientific articles and reports with current emphasis in the subareas of strength, phase transitions, spall, and stress-volume relations. The content of the cited work is described by keywords which are selected and reviewed by scientific advisors. Keywords are organized to provide major and minor descriptors which summarize the technical content in considerable detail. Details of theoretical and experimental approaches are described and major emphasis is identified. In addition to bibliographic information, abstracts are also included, and a field is provided for figure captions and able headings. DOE

N86-12143# Los Alamos Scientific Lab., N. Mex.
STATICS AND ADIABATIC DYNAMICS OF NONLINEAR EXCITATIONS IN DEFECTED POLYACETYLENE
S. R. Phillpot, D. Baeriswyl, A. R. Bishop, and P. S. Lomdahl 1985 12 p Presented at the Synthetic Met. 3 Workshop, Los Alamos, N. Mex., 9 Apr. 1985
(Contract W-7405-eng-36)
(DE85-014118; LA-UR-85-2055; CONF-8504157-2) Avail: NTIS HC A02/MF A01

Within the Su, Schrieffer and Heeger model the effects of model impurities on the electronic structure and lattice distortion of trans-polyacetylene were calculated both analytically and numerically. The electron-phonon coupling may result in a fundamental alteration of the impurity level location. In simulated photoexcitation experiments on the defected system it was found that, in addition to the kinks and breathers produced in undefected system, trapped kinks, excitons and polarons may also be produced. The polarons produced in this novel way may be unusually stable and play an important role in hopping conduction mechanisms. DOE

N86-12144# Brookhaven National Lab., Upton, N. Y.
NEUTRON SCATTERING STUDIES OF THE HEAVY FERMION SUPERCONDUCTORS
A. I. Goldman 1985 14 p Presented at the Mater. and Mech. of Superconductivity Conf., Ames, Iowa, 20 May 1985
(Contract DE-AC02-76CH-00016)
(DE85-014829; BNL-36647; CONF-8505138-13) Avail: NTIS HC A02/MF A01

Recent neutron scattering measurements of the heavy Fermion superconductors are described. Those materials offer an exciting opportunity for neutron scattering since the f-electrons, which couple directly to magnetic scattering measurements, seem to be the same electrons which form the superconducting state below T sub c. In addition, studies of the magnetic fluctuations in these, and other heavy Fermion systems, by inelastic magnetic neutron scattering can provide information about the nature of the low temperature Fermi liquid character of these novel compounds. DOE

N86-12145# California Univ., Berkeley. Lawrence Berkeley Lab.
MODEL OF AMORPHOUS SILICON LAYER REGROWTH
P. Ling and J. Washburn Apr. 1985 10 p refs Presented at the 2nd Spring Meeting of the Mater. Res. Soc., San Francisco, 15 Apr. 1985
(Contract DE-AC03-76SF-00098)
(DE85-012608; LBL-19452; CONF-850421-9) Avail: NTIS HC A02/MF A01

A new model which combines heterogeneous nucleation and growth process to explain the mechanism of the crystal regrowth of amorphous silicon, in contact with a Si single crystal substrate, is presented. This model explains the effects of substrate orientation and impurity concentration on the kinetics of crystal regrowth. A comparison of experimental results with the predictions of the model is also included. DOE

N86-12146# Oak Ridge National Lab., Tenn.
FORMATION, ION MODIFICATION AND ANNEALING OF VN
J. R. Thompson, J. T. Ellis, D. K. Christen, J. D. Lewis, and S. T. Sekula Apr. 1985 18 p refs Presented at the Mater. and Mech. of Superconductivity Conf., Ames, Iowa, 29 May 1985 Prepared in cooperation with Tennessee Univ., Knoxville
(Contract DE-AC05-84OR-21400)
(DE85-012896; CONF-8505138-3) Avail: NTIS HC A02/MF A01

Thin films of vanadium nitride, formed by diffusion of N2 gas into previously characterized vanadium films, have been modified using ion beam techniques. Irradiation by N-ions produced decreases in the superconductive transition temperature T/sub c/ and electrical resistance ratio RRR, which saturated at 3.6 K and 1.0, respectively. It was found that films with higher T/sub c/ values were less susceptible to ion-damage. An isochronal annealing study revealed several annealing stages and nearly complete recovery of T/sub C/. Laser annealing of this brittle material was rather ineffective, however. The results of this work are related to the possible formation of high T/sub c/, B1 phase Mon. DOE

N86-12147# Brookhaven National Lab., Upton, N. Y.
ICOSAHEDRAL INCOMMENSURATE CRYSTALS
P. Bak 1985 11 p Presented at the NATO Advan. Study Inst. Advan. Study Inst. on Scaling Phenomena in Disordered Systems, Geilo, Norway, 4 Aug. 1985
(Contract DE-AC02-76CH-00016)
(DE85-012512; BNL-36437; CONF-850882-1) Avail: NTIS HC A02/MF A01

The icosahedral structures can be described by 6d space group symmetries and their stability can be understood from a simple Landau theory. The task of the crystallographer is to determine the basis associated with the 6d Bravais lattice. The elastic properties and the elementary excitations can be discussed in terms of these symmetries. The ideal icosahedral structures have complete long range order, with sharp Bragg peaks; it is certainly incorrect to consider them to be intermediate between crystals and glasses; they are crystals. It is not difficult to show that the structures are stable with respect to thermal fluctuations, which simply give rise to a reduction of the Bragg peak intensity. The melting transition is first order since the free energy includes third order terms. In a sense the icosahedral structures are incommensurate structures with only one length scale 2(Pi)/tau sub i. The incommensurability comes about because of the relative rotations of the 6 fundamental vectors tau sub i: it is not possible to write any of the 6 vectors as sums of rational multiples of the remaining 5 vectors. DOE

N86-12148# Los Alamos Scientific Lab., N. Mex.
EOS FOR POLYCRYSTALLINE QUARTZ
J. D. Johnson and S. P. Lyon May 1985 7 p refs
(Contract W-7405-eng-36)
(DE85-014241; LA-10391-MS) Avail: NTIS HC A02/MF A01

A new equation of state for polycrystalline quartz, material number 7383, was placed on the SESAME Library. DOE

N86-12149# Los Alamos National Lab., N. Mex.
NUCLEAR INTERLEVEL TRANSFER DRIVEN BY ELECTRONIC TRANSITIONS
J. C. Solem and G. Rinker 1985 20 p refs Presented at the IDA Workshop on Gamma-Ray Lasers, Alexandria, Va., 21 May 1985
(Contract W-7405-eng-36)
(DE85-014103; LA-UR-85-2119; CONF-8505174-1) Avail: NTIS HC A02/MF A01

It is show how a gamma-ray laser might be made by optically exciting a transfer of population from a long-lived isomer to an energetically adjacent short-lived state of the same nucleus. The advantages of using are compared. Preliminary numerical investigations of the mechanism show it to be somewhat favorable. DOE

N86-12150# Argonne National Lab., Ill.
MAGNETIC MEASUREMENTS OF MONOLAYER-THICKNESS FILMS OF Cr SANDWICHED BY Au
M. B. Brodsky, L. R. Sill, and C. H. Sowers Jun. 1985 13 p Presented at the Intern. Conf. on Magnetism, San Francisco,

26 Aug. 1985
(Contract W-31-109-eng-38)
(DE85-015005; CONF-850890-9) Avail: NTIS HC A02/MF A01

Calculations show ferromagnetic moments (3.1(MU) sub B) in Au-Cr-Au sandwiches, for monolayers of Cr. The measured moment (0.41(MU) sub B at 2(0)K) is larger in Cr monolayers than for thicker Cr samples. Results are discussed in terms of other studies of this system including those which showed superconductivity. DOE

N86-12151# McElroy (Ralph) Co., Austin, Tex.
INVESTIGATION ON GROWTH AND LASER PROPERTIES OF GGG:(Nd,Cr) SINGLE CRYSTAL
L. Zhang, C. Lin, H. Liu, L. Liu, H. Zhu, and X. Lin Jun. 1985 16 p refs Transl. into ENGLISH of unknown Chinese article
(Contract W-7405-eng-48)
(DE85-014282; UCRL-Trans-12067) Avail: NTIS HC A02/MF A01

Investigation of the growth and laser properties of gadolinium gallium garnet crystal doped with Nd and Cr is reported. As the segregation coefficient of Nd in GGG is less than 1 and that of Cr is greater than 1, a modified Czochralski method for growth is adopted in order to keep the dopants from being uniform in the growth crystal. DOE

N86-12152# American Inst. of Mining, Metallurgical, and Petroleum Engineers, Inc., Washington, D. C.
INTERNATIONAL PROJECT IN HISTORY OF SOLID STATE PHYSICS Final Report
S. R. Weart Sep. 1984 5 p refs
(Contract DE-FG02-81ER-10864)
(DE85-014843; DOE/ER-10864/1) Avail: NTIS HC A02/MF A01

The International Project in History of Solid State Physics got underway in 1981, planning a large collaborative program to preserve and make known the history of this field. The Project's scholars and sponsors were spurred by the realization that although solid state physics is one of the most important influences on late twentieth century civilization, its history was all but unknown to historians, to the public at large, and even to most physicists. The chief aim of the Project was to create a new and enduring area of historical activity, and this aim was accomplished. As we hoped, most of the scholars who have been drawn to this field plan to continue to study and publish in the history of solid state physics, building upon the research and resources assembled under the Project. DOE

N86-12153# Argonne National Lab., Ill.
MICROSCOPIC INVESTIGATION OF NbN SPUTTERED FILMS
K. E. Gray, R. T. Kampwirth, D. W. Capone, II, and R. Vaglio 29 May 1985 12 p refs Presented at Mater. and Mech. of Superconductivity Conf., Ames, Iowa, 29 May 1985
(Contract W-31-109-eng-38)
(DE85-015000; CONF-8505138-11) Avail: NTIS HC A02/MF A01

Many favorable properties of niobium nitride (NbN) sputtered films for high field magnets are significantly less favorable in bulk NbN (and other high-field superconductors) so that differences in the microstructure of sputtered NbN films are likely responsible for the improvements. Very thin transverse sections of sputtered films were studied by TEM. Such studies reveal columnar grains. Tunneling measurements that directly investigate T sub c and the energy gap of individual grains are discussed. By placing electrodes above and below the film, preliminary measurements of the intrinsic resistivity of the individual columnar grains indicate values significantly less than the transport value. Measurements of the critical current density, J sub c, in NbN suggest that shearing of the flux line lattice does not limit J sub c, as in A-15 superconductors, no doubt due to the high density of pinning centers in NbN. DOE

N86-12154# Syracuse Univ., N. Y. Dept. of Physics.
NUCLEAR SPIN-POLARIZED HD, D2, HT AND DT SOLIDS, LIQUIDS AND HIGH DENSITY GASES Quarterly Status Report, 1 Mar. - 31 May 1985
27 Jun. 1985 5 p
(Contract DE-FG02-84ER-53179)
(DE85-014136; DOE/ER-53179/T4; QSR-5) Avail: NTIS HC A02/MF A01

Success is reported in attaining extremely pure o-D2 in the 0.997 to 0.999 range by symmetry species conversion at a temperature of 4K on a partially activated charcoal catalyst. Spin-lattice relaxation times were improved to over 1 minute. Long storage times and the possibility of liquefaction without depolarizing the o-D2 are expected. Super pure o-D2 may also be used to probe magnetic impurities on surfaces. In addition, 50 kV white spectrum X-ray irradiated solid D2 experiments have yielded information on defect generation rates and defect lifetimes, as well as their effect on para-ortho D2 conversion. Experiments were also begun in epitaxial deposition of D2 on HD, and HD on mostly p-H2. Tests of a dilution refrigerator were completed. DOE

N86-12155# Los Alamos National Lab., N. Mex.
SURFACE IMPEDANCE OF SEVERAL MAGNETIC SUPERCONDUCTORS
M. K. Hou, C. Y. Huang, M. B. Maple (California Univ., San Diego, La Jolla), M. S. Torikachvili (California Univ., San Diego, La Jolla), and H. C. Hamaker (California Univ., San Diego, La Jolla) 1985 13 p refs Presented at the Intern. Conf. on Magnetism, San Francisco, 26-30 Aug. 1985
(Contract W-7405-eng-36)
(DE85-014101; LA-UR-85-2142; CONF-850890-5) Avail: NTIS HC A02/MF A01

Spin fluctuation effect plays an important role in determining the surface impedance, Z/sub s/, in magnetic superconductors. The suppression of spin fluctuations in Er/sub 0.5/Ho/sub 0.5/Rh4B4 gives rise to an abrupt change of Z/sub s/ at the critical temperature T/sub c2/. However, gradual changes of Z/sub s/ for SmRh4B4 and ErRh4B4 were observed in superconducting state. DOE

N86-12156# California Univ., Livermore. Lawrence Livermore Lab.
NEW HARMONIC MATERIALS: INDEX ENGINEERING: THIN-THICK QUADRATURE FREQUENCY CONVERSION
D. Eimerl 7 Feb. 1985 4 p
(Contract W-7405-eng-48)
(DE85-012976; UCRL-92086) Avail: NTIS HC A02/MF A01

The quadrature conversion scheme is a method of generating the second harmonic. The scheme has several advantages over single-crystal or other two crystal schemes. The most important is that it is capable of high conversion efficiency over a large dynamic range of drive intensity and detuning angle. A pair of KDP crystals cut for type-II phase matching are considered. In the quadrature scheme, the optic axes of the crystals are arranged so that the plans containing the direction of the laser beam and their optic axes (the kz planes) are mutually perpendicular. This arrangemnt has two important properties in type-II phase matching, the incident wave is polarized at 45 deg to the kz plane of the crystal. This is in the quadrature scheme, if the incident wave is correctly polarized for efficient conversion in the first crystal, it is also correctly polarized for efficient conversion in the second crystal. Both crystals can convert efficiently. DOE

N86-11862# Sandia Labs., Albuquerque, N. Mex. Thermophysical Properties Div.
OPTICAL MODELING OF MULTILAYER THIN/THICK FILMS Abstract Only
Richard B. Pettit *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 10-11 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

N86-11864# Sandia Labs., Albuquerque, N. Mex. Theoretical Div.
CALCULATION OF THE ELECTRON BACKSCATTERING COEFFICIENT BY MONTE CARLO SIMULATION Abstract Only
Arlyn J. Antolak and William Williamson, Jr. (Toledo Univ.) *In*

LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 11 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

N86-11878# Sandia Labs., Albuquerque, N. Mex. Computational Physics and Mechanics Div.
FINITE DIFFERENCE CALCULATIONS OF VOLTAGES GENERATED IN THIN DIELECTRIC LAYERS SUBJECTED TO SHOCK LOADING Abstract Only
Jeffrey W. Swegle *In* LANL 6th Bien. CUBE (Computer Use by Engineers) Symp. Aug. 1984 p 44-45 (For primary document see N86-11858 02-60)
Avail: NTIS HC A06/MF A01

N86-11931# Joint Publications Research Service, Arlington, Va.
Pb(1-x)Sn(x)Te AND Pb(1-y)Sn(y)Se LASER CRYSTALS Abstract Only
Xiaochun Zhu, Gendi Cao, and Weizai Zhang *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-014) 2 May 1985 p 84 Transl. into ENGLISH from Zhongguo Jiguang (Shanghai), v. 12, no. 1, 20 Jan. 1985 p 48-50 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

N86-11934# Joint Publications Research Service, Arlington, Va.
THE RELATIONS BETWEEN VOLTAGE AND MAGNETIC FIELD OF SUPERCONDUCTING WEAKLINK (1) Abstract Only
Yuheng Zhang and Jun Wang *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-014) 2 May 1985 p 89 Transl. into ENGLISH from Wuli Xuebao (Beijing), v. 33, no. 7, Jul. 1984 p 952-958 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

N86-11935# Joint Publications Research Service, Arlington, Va.
THE RELATIONS BETWEEN VOLTAGE AND MAGNETIC FIELD OF SUPERCONDUCTING WEAKLINK (2) Abstract Only
Yuheng Zhang and Jun Wang *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-014) 2 May 1985 p 90 Transl. into ENGLISH from Wuli Xuebao (Beijing), v. 33, no. 7, Jul. 1984 p 959-966 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

N86-11936# Joint Publications Research Service, Arlington, Va.
DISCUSSION OF THE SUPERCONDUCTING CRITICAL TEMPERATURE IN A N-S MULTI-FILM STRUCTURE Abstract Only
Changde Gong, Dingyu Xing, and Mei Liu *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-014) 2 May 1985 p 91 Transl. into ENGLISH from Wuli Xuebao (Beijing), v. 33, no. 7, Jul. 1984 p 967-974 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

N86-11937# Joint Publications Research Service, Arlington, Va.
THEORY OF THE CRITICAL TEMPERATURE FOR SUPERCONDUCTORS WITH SMALL LAMBDA (1) Abstract Only
Hangsheng Wu and Zhengyu Weng *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-014) 2 May 1985 p 92 Transl. into ENGLISH from Wuli Xuebao (Beijing), v. 33, no. 7, Jul. 1984 p 975-988 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

N86-11938# Joint Publications Research Service, Arlington, Va.
EFFECT OF HIGH ELECTRIC FIELD ON MINORITY CARRIER GENERATION IN SILICON DEPLETION LAYER Abstract Only
Zhijian Li, Lilin Tian, and Xinrong Ma *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-014) 2 May 1985 p 94 Transl. into ENGLISH from Bandaoti Xuebao (Beijing), v. 6, no. 1, Jan. 1985 p 1-10 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

N86-11939# Joint Publications Research Service, Arlington, Va.
DEEP-LEVEL DEFECTS IN ION-IMPLANTED AND CO2 LASER-ANNEALED SILICON Abstract Only
Ximao Bao, Xinyu Zhang, and Chengen Liu *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-014) 2 May 1985 p 95 Transl. into ENGLISH from Bandaoti Xuebao (Beijing), v. 6, no. 1, Jan. 1985 p 11-18 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

N86-11940# Joint Publications Research Service, Arlington, Va.
BINDING ENERGY OF DONORS IN GaAs-Ga(1-x) Al(x)As QUANTUM WELL STRUCTURES Abstract Only
Zhenping Liu and Tianke Li *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-014) 2 May 1985 p 97 Transl. into ENGLISH from Bandaoti Xuebao (Beijing), v. 6, no. 1, Jan. 1985 p 32-40 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

N86-11941# Joint Publications Research Service, Arlington, Va.
AN INTERFACIAL ANALYSIS OF MoNb-GaAs SCHOTTKY BARRIER DIODES Abstract Only
Mingren Yu, Furong Zhu, Xun Wang, Binqi Wang, and Kai Shao *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-014) 2 May 1985 p 100 Transl. into ENGLISH from Bandaoti Xuebao (Beijing), v. 6, no. 1, Jan. 1985 p 55-60 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

N86-11942# Joint Publications Research Service, Arlington, Va.
THERMAL POST-TREATMENT CHARACTERISTICS OF METASTABLE CARRIER CONCENTRATION IN As-IMPLANTED SILICON AFTER TRANSIENT ANNEALING Abstract Only
Li Xu, Peixin Qian, Dongyan Hou, Yusheng Wang, Jianhua Yan, and Shengnan Zheng *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-014) 2 May 1985 p 102 Transl. into ENGLISH from Bandaoti Xuebao (Beijing), v. 6, no. 1, Jan. 1985 p 76-81 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

N86-11943# Joint Publications Research Service, Arlington, Va.
DEEP LEVELS IN SEMI-INSULATING GaAs Abstract Only
Binglin Zhou and Zhengxiu Chen *In its* China Rept.: Sci. and Technol. (JPRS-CST-85-014) 2 May 1985 p 103 Transl. into ENGLISH from Bandaoti Xuebao (Beijing), v. 6, no. 1, Jan. 1985 p 100-103 (For primary document see N86-11918 02-70)
Avail: NTIS HC A06/MF A01

N86-11952# Joint Publications Research Service, Arlington, Va.
CONVERSION OF ELECTROMAGNETIC WAVE ENERGY TO ELECTRICAL CURRENT BY BULK SUPERLATTICE SEMICONDUCTORS Abstract Only
M. M. Kechiyev, A. A. Kostenko, V. D. Kurek, O. A. Kuznetsov, V. A. Tolomasov, O. N. Filatov, G. I. Khlopov, and V. P. Shestopalov *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 7 refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 279, no. 3, Nov. 1984 p 606-608 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

N86-11953# Joint Publications Research Service, Arlington, Va.
CAUSE OF OCCURRENCE OF HIGH-ENERGY IONS DURING UV LASER IRRADIATION OF MOLECULAR CRYSTALS Abstract Only
S. Ye Yegorov and A. N. Shibanov *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 7-8 refs Transl. into ENGLISH from Zh. Teckh. Fiz. (Leningrad), v. 54, no. 11, Nov. 1984 p 2270-2274 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N86-12157# California Univ., Berkeley. Lawrence Berkeley Lab.
EPR: WHAT HAS IT TAUGHT US
H. P. Stapp May 1985 9 p refs Presented at the Symp. on the Found. of Modern Phys., Joensuu, Finland, 16 Jun. 1985
(Contract DE-AC03-76SF-00098)
(DE85-014525; LBL-19642; CONF-850683-2) Avail: NTIS HC A02/MF A01

Eistein, Podoisky, and Rosen (EPR) paper is discussed. The EPR paper was counterproductive for the following reasons: (1) the work was quickly rebutted by Bohr and this rebuttal was accepted my most workers in the field; (2) scientists who adopted the position advocated by Bohr produced, useful theory, whereas those following the course suggested by EPR produced nothing of any certified practical value; (3) it was shown by Bell that the conclusion reached by EPR is incompatible with their assumptions. The behavior of quantum mechanical systems that are very small, yet large enough to influence their environment in ways that appreciably modify their own behavior, vis-a-vis the behavior they would have if isolated was investigated. Because these systems are neither small enough to be treated as isolated between preparation and detection, nor large enough to be treated classically, they do not conform to the format demanded by the Copenhagen interpretation. The behavior of these systems depends on ontological considerations that were irrelevant in the situations covered by the Copenhagen interpretation, and that were systematically ignored in that interpretation. The task of enlarging the scope of quantum theory to cover these new situations, and comparing the empirical consequences of various ontological assumptions is discussed. DOE

N86-11989# Joint Publications Research Service, Arlington, Va.
HYDROTHERMODYNAMICS OF THE NEAR-SURFACE LAYER OF A LIQUID AND OPTICAL METHODS OF INVESTIGATING IT
O. D. Fedorovskyy *In its* USSR Rept.: Phys. and Math. (JPRS-UPM-85-005) 20 Aug. 1985 p 107-115 refs Transl. into ENGLISH from Visnyk Akad. Nauk Ukrayinskoyi RSR (Kiev), no. 11, Nov. 1984 p 15-21 (For primary document see N86-11945 02-70)
Avail: NTIS HC A08/MF A01

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

N86-12158*# National Academy of Sciences - National Research Council, Washington, D. C.
NASA-UNIVERSITIES RELATIONSHIPS IN AERO/SPACE ENGINEERING: A REVIEW OF NASA'S PROGRAM
1985 33 p refs
(NASA-CR-176307; NAS 1.26:176307) Avail: NTIS HC A03/MF A01 CSCL 05I

NASA is concerned about the health of aerospace engineering departments at U.S. universities. The number of advanced degrees in aerospace engineering has declined. There is concern that universities' facilities, research equipment, and instrumentation may be aging or outmoded and therefore affect the quality of research and education. NASA requested that the National Research Council's Aeronautics and Space Engineering Board (ASEB) review NASA's support of universities and make recommendations to improve the program's effectiveness. G.L.C.

N86-11993# Joint Publications Research Service, Arlington, Va.
PROBLEMS, TRENDS IN TECHNICAL EDUCATION OF RESEARCHERS
O. M. Belotserkovskiy *In its* USSR Rept.: Sci. and Technol. Policy (JPRS-UST-85-014) 25 Sep. 1985 p 52-62 Transl. into ENGLISH from Vest. Vyssey Shkoly (Moscow), no. 5, May 1985 p 25-29 (For primary document see N86-11990 02-70)
Avail: NTIS HC A06

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N86-12159# Oak Ridge National Lab., Tenn.
DISTINCT CHARACTERISTICS OF SCIENCE
L. G. Christophorou 22 Jan. 1985 17 p
(Contract DE-AC0-584OR-21400)
(DE85-006533; DOE/OR-21400/T144) Avail: NTIS HC A01/MF A01

The following principles of science are identified: relatedness, embeddedness, coordinating principle, correspondence, scientific parsimony, complementarity, and continuity. The scientific method and the people who work in science are discussed. DOE

N86-11991# Joint Publications Research Service, Arlington, Va.
BOOK ON PLANNING OF SCIENTIFIC, TECHNICAL PROGRESS
A. N. Andrukhovich, V. Yu. Budvey, T. N. Kalinovskaya, B. P. Krasnoglazov, V. M. Likhtenshteyn, L. I. Maksimov, V. L. Mershko, Ye. V. Sapilov, P. A. Sedlov, and T. L. Sletova *In its* USSR Rept.: Sci. and Technol. Policy (JPRS-UST-85-014) 25 Sep. 1985 p 11-14 Transl. into ENGLISH from Oshchestvennyye Nauki v SSSR, Ser. 2: Ekonomika (Referativnyy Zh.) (Moscow), no. 1, Jan. - Feb. 1985 p 60-64 (For primary document see N86-11990 02-70)
Avail: NTIS HC A06

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software.*

N86-12160# Air Command and Staff Coll., Maxwell AFB, Ala.
A COMPUTER-BASED EDUCATIONAL APPROACH TO THE AIR COMMAND AND STAFF COLLEGE ASSOCIATE PROGRAM
J. A. Gaudet Apr. 1985 81 p
(AD-A156460; ACSC-85-0925) Avail: NTIS HC A05/MF A01 CSCL 09/2

The ACSC Associate Program will incorporate Computer-Based Education (CBE) by the Fall of 1987. The college obtained the McGraw-Hill Interactive Authoring System as an authoring tool that has the potential to aid the faculty with CBE. The study explains the reasons for using CBE and examines the McGraw-Hill computer program for its utility to ACSC. The advantages and limitations of this authoring system are discussed. A methodology is presented which will be helpful in designing CBE. The study concludes that the McGraw-Hill Interactive Authoring System will be useful in initiating CBE. However, supplementing computer programs will be necessary to perform computer management functions. GRA

N86-12161# California Univ., Livermore. Lawrence Livermore Lab.
ANNOTATED BIBLIOGRAPHY OF HUMAN FACTORS APPLICATIONS LITERATURE

D. B. McCafferty 30 Sep. 1985 315 p Prepared in cooperation with Essex Corp., Alexandria, Va.
(Contract W-7405-eng-48)
(DE85-012957; UCRL-15674) Avail: NTIS HC A14/MF A01

The material is a revision and expansion of the bibliographic material developed in FY 1982 as part of a previous human factors technology project. The previous bibliography was published September 30, 1982, as Attachment 1 to the FY 1982 Project Status Report. DOE

N86-11996# Joint Publications Research Service, Arlington, Va.
NEW R AND D IN CHINESE LANGUAGE INFORMATION PROCESSING Abstract Only
In its China Rept.: Sci. and Technol. (JPRS-CST-85-015) 16 May 1985 p 11-12 Transl. into ENGLISH from Jisuanji Shijie (Beijing), no. 7, 8 Apr. 1984 p 7 (For primary document see N86-11994 02-70)
Avail: NTIS HC A07/MF A01

N86-11999# Joint Publications Research Service, Arlington, Va.
THIRD NATIONAL ACADEMIC MACHINE RETRIEVAL CONFERENCE HELD IN ZHENJIANG Abstract Only
In its China Rept.: Sci. and Technol. (JPRS-CST-85-015) 16 May 1985 p 26-27 Transl. into ENGLISH from Jisuanji Shijie (Beijing), no. 1, 8 Jan. 1984 p 1 (For primary document see N86-11994 02-70)
Avail: NTIS HC A07/MF A01

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N86-12162# Air Command and Staff Coll., Maxwell AFB, Ala.
COMMERCIALIZATION OF SPACE: NATIONAL POLICY AND DEFENSE NEEDS Student Report
J. J. Taylor Apr. 1985 57 p
(AD-A156517; ACSC-85-2675) Avail: NTIS HC A04/MF A01 CSCL 22/1

This report evaluates potential impacts of commercialization of space on U.S. space policy and space defense needs for the future. Historical trends of U.S. space commercialization and U.S. space policy form a foundation for projecting space commercialization out to the year 2025. The report contains tables and figures of space vehicle launch statistics, satellite launches, satellite lifetimes, capital investment in satellites, revenues from space industry, and other quantitative data. The study concludes that future U.S. space defense must include security needs of U.S. space-based commercial assets. Author (GRA)

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N86-12163# State Dept., Washington, D. C. Bureau of Public Affairs.
US SPACE PROGRAMS: COOPERATION AND COMPETITION FROM EUROPE
Harry R. Marshall, Jr. and Cynthia Saboe, ed. May 1985 6 p
(BPA-CP-695) Avail: NTIS HC A02/MF A01

International activities demonstrate the many applications of space science and technology for peaceful purposes and provide opportunities for contribution by scientists of other countries to the tasks of increasing human understanding and use of space. Cooperative activities range from flight of foreign spacecraft to groundbased study and analysis of data. Activities include contributions of experiments or payloads to be flown in space, joint projects to develop flight hardware, use of data provided by satellites, and joint publication of scientific results. These cooperative programs are generally carried out under government-to-government science and technology agreements coordinated by the State Department. In addition, NASA provides, on a reimbursable basis, commercial services such as deployment of telecommunication satellites. G.L.C.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N86-12164# Massachusetts Inst. of Tech., Cambridge.
[RESEARCH OBJECTIVES AND SUMMARY OF RESEARCH PERFORMED BY THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY RESEARCH LABORATORY OF ELECTRONICS]
J. Allen and R. Birgeneau Jan. 1985 270 p refs
(PR-127) Avail: NTIS HC A12/MF A01

A series of Progress Reports issued by the Research Laboratory of Electronics contains the customary annual statement of research objectives and summary of research for each group. The report covers the period January 1, 1984-December 31, 1984, and the source of support is indicated for each project. The topics include: (1) submicron structures technology and research; (2) kinetic phenomena in thin film electronic materials; (3) focused ion beam fabrication; (4) chemical reaction dynamics at surfaces; (5) optics and quantum electrons; (6) infrared nonlinear optics; (7) phase transitions in chemisorbed systems; (8) X-ray diffuse scattering; (9) semiconductor surface studies; (10) electronic properties of amorphous silicon dioxide; (11) optical spectroscopy of disordered materials; (12) quantum transport in low dimensional disordered systems; (13) photon correlation spectroscopy; (14) custom integrated circuits; (15) speech communication; (16) linguistics; (17) communications biophysics; (18) physiology; (19) molecule microscopy; (20) quantum optics and photonics; (21) atomic resonance and scattering; (22) plasma dynamics; (23) radio astronomy; (24) digital signal processing; (25) cognitive information processing; (26) electromagnetic wave theory and remote sensing; (27) microwave and quantum magnetics; and (28) optical propagation and communication. E.A.K.

N86-12165# Pacific Northwest Lab., Richland, Wash.
ASSESSMENT OF TECHNICAL STRENGTHS AND INFORMATION FLOW OF ENERGY CONSERVATION RESEARCH IN JAPAN. VOLUME 2: BACKGROUND DOCUMENT
G. J. Hane, P. M. Lewis, R. A. Hutchinson, B. Rubinger, and A. Willis Jun. 1985 203 p
(Contract DE-AC06-76RL-01830)
(DE85-013759; PNL-5244-Vol-2) Avail: NTIS HC A10/MF A01

Purpose of this study is to explore the status of R and D in Japan and the ability of US researchers to keep abreast of Japanese technical advances. US researchers familiar with R and D activities in Japan were interviewed in ten fields that are relevant to the more efficient use of energy: amorphous metals, biotechnology, ceramics, combustion, electrochemical energy storage, heat engines, heat transfer, high temperature sensors, thermal and chemical energy storage, and tribology. The researchers were questioned about their perceptions of the strengths of R and D in Japan, comparative aspects of US work, and the quality of available information sources describing R and D in Japan. Of the ten related fields, the researchers expressed a strong perception that significant R and D is under way in amorphous metals, biotechnology, and ceramics, and that the US competitive position in these technologies will be significantly challenged. Researchers also identified alternative emphases in Japanese R and D programs in these areas that provide Japan with stronger technical capabilities. DOE

N86-12166# Tuskegee Inst., Ala.
PROJECT TO STUDY THE USE OF MICROCOMPUTER TECHNOLOGY IN PLANNING AND OPERATION OF SMALL CITY TRANSPORTATION SYSTEMS Final Report
T. S. Sara Sep. 1984 37 p
(Grant DOT-UMTA-AL-06-0011)
(PB85-204873; UMTA-AL-06-0011-85-1) Avail: NTIS HC A03/MF A01 CSCL 13B

The purpose of this research was to study the use of microcomputer technology in the planning and operation of small city transportation systems. Existing and potential planning and administrative applications of microcomputers were identified. Hardware and software capabilities of some of the popular microcomputers in the market were studied in order to determine their uses in small city transportation systems. The following most common activities performed in small city transportation systems were identified: Planning; Scheduling; Transportation; Maintenance; Purchasing and Maintaining Inventory; Accounting and Finance; and Personnel and Labor Relations. Flow charts were used to determine if there existed software and computer hardware to enable small cities to computerize their transportation systems. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N86-12167*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FAR-INFRARED OBSERVATIONS OF SAGITTARIUS B2: RECONSIDERATION OF SOURCE STRUCTURE
Harley A. Thronson, Jr. (Wyoming Univ.) and D. A. Harper (Yerkes Observatory) Oct. 1985 25 p refs Submitted for publication
(NASA-TM-88185; Rept-86009; NAS 1.15:88185; Preprint-Ser-039) Avail: NTIS HC A02/MF A01 CSCL 03A

New moderate-angular-resolution far-infrared observations of the Sagittarius B2 star-forming region are presented, discussed, and compared with recent radio molecular and continuum observations of this source. In contrast to previous analyses, its far-infrared spectrum is interpreted as the result of a massive frigid cloud overlying a more-or-less normal infrared source, a natural explanation for the object's previously-noted pecularities. The characteristics derived for the obscuring cloud are similar to those found for the W51 MAIN object. Both sources have high sub-millimeter surface brightness, a high ratio of sub-millimeter to far-infrared flux, and numerous regions of molecular maser emission. Author

N86-12168*# National Aeronautics and Space Administration, Washington, D. C.
THE 1982-1984 ECLIPSE OF EPSILON AURIGAE
Robert E. Stencel, ed. Sep. 1985 115 p refs Working meeting held in Tucson, Ariz., 16-17 Jan. 1985
(NASA-CP-2384; NAS 1.55:2384; LC-85-13854) Avail: NTIS HC A06/MF A01 CSCL 03A

A workshop proceedings concerned with the new data collected during the 1982-1984 eclipse period of the 27-year system Epsilon Aurigae is presented. This binary star has been a classic problem in astrophysics because the opaque eclipsing object is nonstellar, and probably disk shaped. Invited papers concerning the history of the system, optical, infrared and ultraviolet photometry, optical polarimetry and ultraviolet spectroscopy are included. An invited paper concerning comprehensive theoretical interpretation in the context of stellar evolution also is included. The information collected herein is unparalleled in scope and will remain a standard reference until the next eclipse cycle in the year 2009 A.D., in all probability. For individual titles, see N86-12169 through N86-12184.

N86-12169*# Hopkins Phoenix Observatory, Ariz.
OPTICAL PHOTOMETRY OF THE 1982-1984 ECLIPSE OF EPSILON AURIGAE
Jeffrey L. Hopkins *In* NASA, Washington The 1982-1984 Eclipse of Epsilon Aurigae Sep. 1985 p 7-22 refs (For primary document see N86-12168 02-89)
Avail: NTIS HC A06/MF A01 CSCL 03A

From slightly before the 1982-1984 eclipse of Epsilon Aurigae to the present observers from around the world have been making photoelectric photometry observations of this star system. Over 2000 UBV observations have been reported as well as observations in the R, I, J, H, K, L, M, N, and Q bandpasses plus the y, b, v, and u bandpasses. Twenty nine observers from 9 countries submitted photometry data to the campaign. The data have shown many interesting features of the star system including a Cepheid-like pulsation, flare activity, mid-eclipse brightening, post egress brightening, plus other strange activity. Author

N86-12170*# Hawaii Univ., Honolulu.
INFRARED PHOTOMETRY OF THE 1982-4 ECLIPSE OF EPSILON AURIGAE
D. E. Backman *In* NASA, Washington The 1982-1984 Eclipse of Epsilon Aurigae Sep. 1985 p 23-32 refs Sponsored in part by NSF (For primary document see N86-12168 02-89)
Avail: NTIS HC A06/MF A01 CSCL 03A

The infrared photometry of epsilon Aur performed prior to and during the ingress phase of the recent eclipse allowed the first solid determination of the temperature of the secondary object. The eclipse depth was significantly less at lambda $>$ 5 micrometers than in the near-infrared. This is explained by a model of the secondary as an opaque and very cool object with a temperature of approx. 500 K. During eclipse, the secondary blocks approximately 45% of the near infrared radiation from the primary star. At the same time, the radiation from the secondary remains completely unobscured, resulting in a shallower light curve at longer wavelengths. This phenomenon is well known in the study of eclipsing binary stars; if the two stars have different colors, then the net color of the system changes during eclipse. In the case of epsilon Aur, the eclipsing object has a color deep in the infrared, so the effect is only noticeable there. Author

N86-12171*# Oregon Univ., Eugene. Dept. of Physics.
THE OPTICAL POLARIZATION OF EPSILON AURIGAE THROUGH THE 1982-84 ECLIPSE
J. C. Kemp, G. D. Henson, D. J. Kraus, and I. S. Beardsley *In* NASA, Washington The 1982-1984 Eclipse of Epsilon Aurigae Sep. 1985 p 33-36 (For primary document see N86-12168 02-89)
Avail: NTIS HC A06/MF A01 CSCL 03A

About 350 nights observations on the 61-cm telescope at Pine Mt. Observatory were made of the variable polarization of Eps. Aurigae during 1982-85, in the U, B, and V color bands. The V data are the most complete and are shown. In terms of the overall features the curves in all three colors are quite similar. The typical errors per nightly point in the V curves are about 0.015% for either of the two normalized, equatorial Stokes parameters Q and U. Note that there is a large background or constant component of some 2.5%, position angle around 135 deg. This is presumably largely interstellar, and the intrinsic polarization probably does not much exceed the amplitude of the variable component, approx. 0.5%. A few field-star polarizations were measured but a very clear pattern was not obtained in this part of the sky. Author

N86-12172*# Computer Sciences Corp., El Segundo, Calif.
IUE OBSERVATIONS OF THE 1982-84 ECLIPSE OF EPSILON AURIGAE
Thomas B. Ake *In* NASA, Washington The 1982-1984 Eclipse

of Epsilon Aurigae Sep. 1985 p 37-42 refs (For primary document see N86-12168 02-89)
Avail: NTIS HC A06/MF A01 CSCL 03A

The major characteristics in the ultraviolet of the 1982-84 eclipse of Eps Aur as observed with IUE by various workers are summarized. This star can be observed over the entire IUE wavelength range, from 1200 to 3200 A, in low dispersion, allowing eclipse light curves to be obtained in broadband regions, but due to its steep spectral gradient and the sensitivities of IUE cameras, high resolution exposures adequately cover only the regions from 1700-1900 and 2400-3200 A. In many ways, the UV data confirms or expands upon interpretations of the stem made from observations in other wavelength regions, but in other respects the system remains as enigmatic as before. Author

N86-12173*# Trieste Univ. (Italy). Inst of Astronomy.
THE ECLIPSE OF EPSILON AURIGAE VISIBLE SPECTROSCOPY AND ULTRAVIOLET ACTIVITY
S. Ferluga and M. Hack *In* NASA, Washington The 1982-1984 Eclipse of Epsilon Aurigae Sep. 1985 p 43-48 refs (For primary document see N86-12168 02-89)
Avail: NTIS HC A06/MF A01 CSCL 03A

The preliminary results of the study of several high resolution spectrograms (lambda 3500 - lambda 7000 A), obtained at the Haute Provence Observatory (OHP) in France, at different epochs before, during and after the eclipse are reported. Some of these spectrograms are compared with corresponding IUE high resolution observations, in order to study the effects of the intrinsic UV activity, towards the longer wavelengths. Author

N86-12174*# Joint Inst. for Lab. Astrophysics, Boulder, Colo.
EPSILON AURIGAE IN AN EVOLUTIONARY CONTEXT
Ronald F. Webbink *In* NASA, Washington The 1982-1984 Eclipse of Epsilon Aurigae Sep. 1985 p 49-60 refs (For primary document see N86-12168 02-89)
Avail: NTIS HC A06/MF A01 CSCL 03A

Basic observational data of Epsilon Aurigae are summarized and used as the basis of a discussion of possible evolutionary states of the system. Constraints posed by the presence of a cold disk surrounding the secondary star are also outlined. Possible evolutionary models of the F0 Ia supergiant range from pre-main sequence contraction through shell hydrogen burning, core helium burning, to shell helium burning, depending on the absolute luminosity of the system, for models in which no mass transfer has taken place. Models invoking binary interaction include core and shell helium burning stars, and pre-white dwarfs, again depending on the absolute luminosity of the system. A massive shell helium burning star or a pre-white dwarf mass transfer remnant would appear the most likely of these models at present. Observational tests of these models are briefly outlined. Author

N86-12175*# Vanderbilt Univ., Nashville, Tenn.
PHOTOMETRIC SUPPORT FOR FUTURE ASTONOMICAL RESEARCH
Douglas S. Hall and Russell M. Genet (Fairborn Observatory) *In* NASA, Washington The 1982-1984 Eclipse of Epsilon Aurigae Sep. 1985 p 61-64 refs (For primary document see N86-12168 02-89)
Avail: NTIS HC A06/MF A01 CSCL 03A

The I.A.P.P.P. is described and how that organization can provide photometric support for future astronomical research projects such as the 1982-1984 eclipse of epsilon Aurigae discussed at this workshop. I.A.P.P.P., International Amateur-Professional Photoelectric Photometry, is an organization founded in Fairborn, Ohio by the authors in 1980. Its purpose is to encourage contact between amateur and professional astronomers interested in photoelectric photometry, for their mutual benefit and for the benefit of astronomical research. Aspects dealt with include instrumentation, electronics, computer hardware and software, observing techniques, data reduction, and observing programs. Starting with the June 1980 issue, I.A.P.P.P. has published the quarterly I.A.P.P.P. Communications. The Communications contain articles dealing with all the above aspects of photoelectric photometry, although it does not publish observational results as such. Photoelectric photometry obtained by amateurs is published in the same journals which publish photometry obtained by professionals. Author

N86-12176*# Arizona State Univ., Tempe.
UBV PHOTOMETRY OF THE 1982-4 ECLIPSE OF EPSILON AURIGAE: A DISCUSSION OF THE OBSERVED LIGHT CURVES
Paul C. Schmidtke *In* NASA, Washington The 1982-1984 Eclipse of Epsilon Aurigae Sep. 1985 p 67-74 refs (For primary document see N86-12168 02-89)
Avail: NTIS HC A06/MF A01 CSCL 03A

At least 29 observers in nine countries have contributed photometric measurements of Epsilon Aurigae during the recent observational campaign. The present discussion is limited to data submitted by J. L. Hopkins of the Hopkins Phoenix Observatory and S. I. Ingvarsson of the Tjornisland Astronomical Observatory. Both sources are on the UBV system, with no significant systematic differences. Combined, these two sources cover the entire eclipse, from pre-ingress up to the present (April 1985). It should be noted that this eclipse is the first to have complete photometric coverage in all three broadband filters U, B, and V. Author

N86-12177*# Villanova Univ., Pa.
INTERMEDIATE AND NARROW BAND PHOTOMETRY OF EPSILON AURIGAE Abstract Only
Robert A. Donovan, Edward F. Guinan, and George P. McCook *In* NASA, Washington The 1982-1984 Eclipse of Epsilon Aurigae Sep. 1985 p 77-78 (For primary document see N86-12168 02-89)
Avail: NTIS HC A06/MF A01 CSCL 03A

Intermediate band blue (4530A), far red (7790A) and H-alpha intermediate and narrow band photoelectric observations of the peculiar, 27 year eclipsing binary, Epsilon Aurigae were made from December 1981 through the present (December 1984). BD +42 1170 served as the primary comparison star because of its angular proximity to the variable star. The analysis of this data along with other available photometry was undertaken to study the characteristics of the low amplitude, semi-regular light variations that appear inside and outside of eclipse. It appears that these short term light variations arise from nonradial pulsations of the luminous f supergiant in the system. Furthermore, the semi-regular light variations found for Epsilon Aurigae are similar to those found for other luminous A-F supergiants. Also, the preliminary results from the analyses of the light variations produced by the eclipse of the F-supergiant by the mysterious cooler component is discussed. Author

N86-12178*# Lowell Observatory, Flagstaff, Ariz.
SPECTROPHOTOMETRY OF EPSILON AUR, 3295-8880 A Abstract Only
G. W. Lockwood, D. T. Thompson, B. L. Lutz, and J. Sowell (Michigan Univ.) *In* NASA, Washington The 1982-1984 Eclipse of Epsilon Aurigae Sep. 1985 p 79 (For primary document see N86-12168 02-89)
Avail: NTIS HC A06/MF A01 CSCL 03A

Spectrophotometric scans were obtained at 8 A resolution from 3295 to 8880 A on twenty nights before, during, and after the recent eclipse of epsilon Aurigae, beginning with a pre-eclipse observation on 5 March 1982 U.T. The observations were reduced to absolute flux using the standard stars 109 Vir or xi(2) Ceti. The data confirm that the eclipse is essentially gray over the entire visible spectrum, as others have noted from broadband photometry. High resolution echellograms (450 to 6700 A) made through mid-eclipse and the scans show changes in the equivalent widths of H alpha, Na D, and O I as large as a factor of two. Author

N86-12179*# Kitt Peak National Observatory, Tucson, Ariz.
MICRON CO IN THE ECLIPSE SPECTRUM OF EPSILON AUR
Kenneth H. Hinkle and Theodore Simon (Hawaii Univ.) *In* NASA, Washington The 1982-1984 Eclipse of Epsilon Aurigae Sep. 1985 p 80 Sponsored in part by NSF (For primary document see N86-12168 02-89)

Avail: NTIS HC A06/MF A01 CSCL 03A

Two micrometer spectrum of epsilon Aur was observed at high resolution (lambda/delta lambda approx. 40000) with the KPNO 4m telescope and FTS approximately every 100 days during the recent eclipse. CO delta v=2 lines appeared in the spectrum only after mid-totality. No CO features were present JD 2445478 but weak absorption lines were present on 2445592. The CO strengthened in the spectrum and remained present until at least 2445812. CO was again absent after forth contact when the spectrum was observed on 2445912. The CO appears to originate in a cool (approx. 1000 K), turbulent region. Excitation temperatures, velocities, and column densities is presented.

Author

N86-12180*# National Aeronautics and Space Administration, Washington, D. C.

SCATTERED LIGHT IN THE IUE SPECTRA OF EPSILON AURIGAE

Bruce Aitner (Applied Research Corp.), Robert D. Chapman (NASA. Goddard Space Flight Center), Yoji Kondo (NASA. Goddard Space Flight Center), and Robert E. Stencel *In its* The 1982-1984 Eclipse of Epsilon Aurigae Sep. 1985 p 81-90 refs (For primary document see N86-12168 02-89)

Avail: NTIS HC A06/MF A01 CSCL 03A

As a result of this work it was found that light scattered from the longer wavelengths constitutes a small but non-negligible, wavelength and time dependent fraction of the measured flux in the far UV. The reality of the UV excess has not been unambigiously ruled out. However, it is noted that there are still uncertainties in the assumed scattering profile. New measurements of the scattering properties of the cross disperser grating are planned in order to verify the results of Mount and Fastie and extend the wavelength coverage into the far wings of the profile. The results of these measurements will no doubt reduce some of these uncertainties. For the present, it is felt that the BCH approach is a significant improvement over the methods heretofore available for the treatment of scattered light in IUE spectra. Author

N86-12181*# Arizona Univ., Tucson.

MODELLING EPSILON AURIGAE WITHOUT SOLID PARTICLES

A. Y. S. Cheng and N. J. Woolf *In* NASA, Washington The 1982-1984 Eclipse of Epsilon Aurigae Sep. 1985 p 91 (For primary document see N86-12168 02-89)

Avail: NTIS HC A06/MF A01 CSCL 03A

Three components can be expected to contribute to the emission of epsilon Aurigae. There is a primary F star. There is an opaque disk which occults it, and there is a gas stream which is observed to produce absorption lines. Evidence that the disk is not responsible for the gas stream lines comes both from the radial velocities, which are too small, and from the IR energy distribution out of eclipse, which shows free-free emission that would produce inadequate optical depth in electron scattering. The color temperature of the IR excess can give misleading indications of low temperature material. Free-free emission at 10,000 K between 10 and 20 microns has a color temperature of 350 K. Attempts to mold the system are discussed. Author

N86-12182*# Hopkins Phoenix Observatory, Ariz.

ASTRONOMICAL RESEARCH AT THE HOPKINS PHOENIX OBSERVATORY

Jeffrey L. Hopkins *In* NASA, Washington The 1982-1984 Eclipse of Epsilon Aurigae Sep. 1985 p 93-97 (For primary document see N86-12168 02-89)

Avail: NTIS HC A06/MF A01 CSCL 03A

After trying astrophotography and radio astronomy it was decided that the best way to do meaningful astronomical research at a small private observatory was by doing photoelectric photometry. Having the observatory located in the back yard of a private residence affors the luxury of observing any time the sky conditions permit. Also modest equipment is all that is needed to do accurate UBV photometry of stars 8th magnitude and brighter. Since beginning in 1980 the Hopkins Phoenix Observatory has published papers on several RS CVn star systems, 31 Cygni, 22 Vul, 18 Tau Per, and has followed the 1982-1984 eclipse of Epsilon Aurigae from its start to the present with over 1000 UBV measurements. In addition the Hopkins Phoenix Observatory has developed several pieces of photometry equipment including the HPO PEPH-101 photometer head and photon counting electronics. Author

N86-12183*# Washington Univ., Seattle.

HIGH DISPERSION OBSERVATIONS OF EPSILON AUR FROM SEPT. 1982 TO MARCH 1983 Abstract Only

George Wallterstein *In* NASA, Washington The 1982-1984 Eclipse of Epsilon Aurigae Sep. 1985 p 99-102 (For primary document see N86-12168 02-89)

Avail: NTIS HC A06/MF A01 CSCL 03A

Between September 1982 and March 1983 I obtained high dispersion spectra of epsilon Aur in selected regions using the Palomar 200-inch coude spectrograph and the Dominion Astrophysical Observatory 48-coude spectrograph. All spectra were taken with the 90-mm ITT image tube and IIa-D emulsion. Radial velocities are listed for the sodium D lines, KI lines, H alpha, and a few other features. While most of the sodium and potassium features are surely circumstellar there is certainly an interstellar component present. In the direction of epsilon Aur interstellar gas is seen mostly with radial velocities between +5 and +10 km s(-1). The sodium D lines and potassium lines show incipient resolution which may involve the interstellar components. The equivalent widths of the sodium and potassium lines are given. For potassium, blending with atmospheric O2 makes the line at lambda 7664 unmeasurable on the dates of these observations. The increase in equivalent widths already noted by Pathasarathy and Lambert is evident. Blending and partial resolution of the circumstellar and interstellar features may account for much of the velocity structure which is only partially discernable at the available resolution. Author

N86-12184*# Yonsei Univ., Seoul (South Korea).

PHOTOELECTRIC OBSERVATIONS OF THE LONG-PERIOD ECLIPSING BINARIES AT YONSEI UNIVERSITY OBSERVATORY Abstract Only

Il-Seong Nha, Yong-Sam Lee, Yong-Wood Chun, Ho-Il Kim, and Young-Soo Kim *In* NASA, Washington The 1982-1984 Eclipse of Epsilon Aurigae Sep. 1985 p 103 refs Presented at the 3rd IAU-Asia Pacific Reg. Meeting, Kyoto, Japan, Oct. 1984 (For primary document see N86-12168 02-89)

Avail: NTIS HC A06/MF A01 CSCL 03A

A long term project (ten-years; 1982-92) for the photoelectric observation in the UBV passbands of selected eclipsing binaries with P > 10 days has initiated at Yonsei University Observatory using 40-cm and 61-cm reflectors. The instrumentation used and the observation techniques and the reduction procedures applied to this investigation are described. Author

N86-12185*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

STAR FORMATION IN THE INNER GALAXY: A FAR-INFRARED AND RADIO STUDY OF TWO H2 REGIONS

D. F. Lester, H. L. Dinerstein, M. W. Werner, P. M. Harvey, N. J. Evans, and R. L. Brown Sep. 1985 44 p refs Sponsored in part by the Robert A. Welch Foundation Prepared in cooperation with Texas Univ. and National Radio Astronomy Observatory

(Grant NGR-05-003-511; NASA-Order-NCA2-OR781-201; Grant NSF AST-83-12332)

(NASA-TM-86720; Rept-85221; NAS 1.15:86720) Avail: NTIS HC A03/MF A01 CSCL 03A

Far-infrared and radio continuum maps have been made of the central 6' of the inner-galaxy HII regions G30.8-0.0 (in the W43 complex) and G25.4-0.2, along with radio and molecular line measurements at selected positions. The purpose of this study is an effort to understand star formation in the molecular ring at 5 kpc in galactic radius. Measurements at several far infrared wavelengths allow the dust temperature structures and total far infrared fluxes to be determined. Comparison of the radio and

infrared maps shows a close relationship between the ionized gas and the infrared-emitting material. There is evidence that parts of G30.8 are substantially affected by extinction, even at far-infrared wavelengths. Using radio recombination line and CO line data for G25.4-0.2, the distance ambiguity for this source is resolved. The large distance previously ascribed to the entire complex is found to apply to only one of the two main components. The confusion in distance determination is found to result from an extraordinary near-superposition of two bright HII regions. Using the revised distances of 4.3 kpc for G25.4SE and 12 kpc for G25.4NW, it is found that the latter, which is apparently the fainter of the two sources, is actually the more luminous. The ratio of total luminosity to ionizing luminosity is very similar to that of HII regions in the solar circle. Assuming a coeval population of ionizing stars, a normal initial mass function is indicated. B.W.

N86-12186*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

SUBMILLIMETER OBSERVATIONS OF OH AND CH IN M42

Paul J. Viscuso, Gordon J. Stacy, Charles E. Fuller, Noel T. Kurtz, and Martin Harwit Sep. 1985 28 p refs Submitted for publication Prepared in cooperation with Cornell Univ., Ithaca, N.Y.

(Grant NsG-2347)

(NASA-TM-86723; Rept-85224; NAS 1.15:86723; PP-Ser-32) Avail: NTIS HC A03/MF A01 CSCL 03A

The (sup 2) pi sub 1/2 (J = 3/2 to 1/2) transitions of OH at 163.12 and 163.40 micro m have been detected and upper limits have been obtained for the (sup 2) pi sub 3/2 (J = 3/2 to 1/2) transitions of CH at 149.09 and 149.39 micro m, in observations of the Kleinmann-Low Nebula of Orion. All four flux levels lie between 1 and 1.2 x 10 to the 17th power/sq.cm. The OH lines are bright when compared to the lower, (sup 2) pi sub 3/2 (J = 5/2 to 3/2) fluxes reported and imply that the 119 micro m emission observed is partially self-absorbed. The combined results provide strong constraints. Taken together with existing data on molecular hydrogen and CO and recent data on other OH transition, they suggest OH emission from post-shock regions at temperatures T approx 1000 k, densities approx. 7 x 10 to the 6th powr/cu cm N sub OH approx 80/cu cm optically thick for the (sup 2) pi sub 3/2 (J = 5/2 to 3/2), 119 micro m but only partially self-absorbing in the (J = 7/2 to 3/2), 84 micro m transitions over a Doppler velocity bandwidth of 30 km/sec. The OH column density is N sub OH approx 4 x 10 to the 16th powr/sq cm. in the emitting regions which occupy a fraction of approx 0.1 of a 1' x 1' field of view centered on the Becklin-Neugebauer source. The CO (J = 31 to 30), 84 micro m transition appears to lie sufficiently close to one of the 84 micro m OH line components to be partially absorbed as well, through a Bowen-type mechanism. Author

N86-12187*# University of Southern California, Los Angeles. Dept. of Astronomy.

APPLICATIONS OF THE MAGNETO-OPTICAL FILTER TO STELLAR PULSATION MEASUREMENTS

Edward J. Rhodes, Jr., Alessandro Cacciani, and Steven Tomczyk [1984] 17 p refs

(Grants NAGw-13; NAGw-472)

(NASA-CR-176282; NAS 1.26:176282) Avail: NTIS HC A02/MF A01 CSCL 03A

A proposed method of employing the Cacciani magneto-optical filter (MOF) for stellar seismology studies is described. The method relies on the fact that the separation of the filter bandpasses in the MOF can be changed by varying the level of input power to the filter cells. With the use of a simple servosystem the bandpass of a MOF can be tuned to compensate for the changes in the radial velocity of a star introduced by the orbital motion of the Earth. Such a tuned filter can then be used to record intensity fluctuations through the MOF bandpass over an extended period of time for each given star. Also, the use of a two cell version of the MOF makes it possible to alternately chop between the bandpass located in the stellar line wing and a second bandpass located in the stellar continuum. Rapid interchange between the two channels makes it possible for atmospheric-introduced noise to be removed from the time series. Author

N86-12188*# Smithsonian Astrophysical Observatory, Cambridge, Mass.

BALLOON-BORNE THREE-METER TELESCOPE FOR FAR-INFRARED AND SUBMILLIMETER ASTRONOMY Semiannual Status Report, 1 Mar. - 31 Aug. 1984

Giovanni G. Fazio Oct. 1985 18 p

(Grant NAGw-509)

(NASA-CR-176285; NAS 1.26:176285; SASR-2) Avail: NTIS HC A02/MF A01 CSCL 03A

This is the second Semiannual Report submitted under Grant NAGW-509 for the development of a Balloon-Borne Three-Meter Telescope for Far-Infrared and Submillimeter Astronomy. It covers the period 1 March 1984 through 31 August 1984. This grant covers work at the Smithsonian Astrophysical Observatory (SAO), University of Arizona (UA) and the University of Chicago (UC). SAO is responsible for program management, the gondola structure including the attitude control and aspect systems, mechanical systems, and telemetry and command systems; the UA is responsible for optics design and fabrication; the UC is responsible for determining provisions for focal-plane instrumentation. SAO and the UA share responsibility for the ground support data and control computer. Author

N86-12189# Aerospace Corp., Los Angeles, Calif. Space Sciences Lab.

THE MASS OF HOT, SHOCKED CO IN ORION: FIRST OBSERVATIONS OF THE J = 17 YIELDS J = 16 TRANSITION AT 153 MICRONS

G. Stacy, N. T. Kurtz, S. Smyers, M. Harwit, and R. W. Russell 24 Jun. 1985 20 p Prepared in cooperation with Cornell Univ., Ithaca, N.Y. and Harvard-Smithsonian Center for Astrophysics, Cambridge, Mass.

(Contract F04701-83-C-0084)

(AD-A157323; TR-0084A(5940-01)-3; SD-TR-85-28) Avail: NTIS HC A02/MF A01 CSCL 03/1

We have observed the Kleinmann-Low Nebula in Orion and detected the J = 17 to J = 16 transition of carbon monoxide at a flux level of 7 x 10 to the -17th power W/sq cm. Our best estimate for the total mass of hot, T approx. 750 K, CO in the nebula is 8 x 10 to the 30th power g. From this value we assess the total hydrogen mass at this temperature to be approx. 1.5 solar mass. A puzzling apparent deficit of oxygen in the nebula is discussed. GRA

N86-12190# Smithsonian Astrophysical Observatory, Cambridge, Mass.

A LASER SIDEROSTAT Final Report, 24 Apr. 1984 - 23 Apr. 1985

M. Shao 25 Jun. 1985 4 p

(Contract N00014-84-C-2137)

(AD-A157444) Avail: NTIS HC A02/MF A01 CSCL 03/1

The Mark III Astrometric Interferometer is an instrument designed to improve on our ability to measure angular positions of stars by more than an order of magnitude. The instrument makes extensive use of active optics, digital signal processing and control, and laser metrology. This report describes the efforts of the first year of a four-year program to build the Mark III interferometer, as well as obstacles to technical progress due to Navy administrative procedures. GRA

N86-11575# Academy of Sciences, Potsdam (East Germany). Zentralinst. fuer Physik der Erde.

INFLUENCES OF SYSTEMATIC DIFFERENCES BETWEEN DIFFERENT STAR CATALOGUES ON THE RESULTS OF LATITUDE AND TIME DETERMINATIONS WITH THE PZT 2

M. Mainig *In its* Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 2 1985 p 45-54 refs (For primary document see N86-11568 02-42)

Avail: NTIS HC A09/MF A01

N86-11584# Technische Univ., Dresden (East Germany). Sektion Geodaesie und Kartographie.

PLANETS AROUND BARNARD'S STAR?

Klaus-Guenter Steinert *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 2 1985 p 126-128 refs *Its* Mitteilung des Lohrmann-Observatoriums No. 52 (For primary document see N86-11568 02-42)
Avail: NTIS HC A09/MF A01

N86-11588# Academia Sinica, Beijing (China). Inst. of Geodesy and Geophysics.
ON THE COMPARISON AND CHOICE BETWEEN THE FORMULAS OF THE EARTH TIDAL CORRECTION IN ASTRONOMICAL TIME AND LATITUDE OBSERVATION
Jiongyu Xia *In* Academy of Sciences of the GDR Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth, Pt. 2 1985 p 144-149 refs (For primary document see N86-11568 02-42)
Avail: NTIS HC A09/MF A01

N86-12000# Joint Publications Research Service, Arlington, Va.
MICROCOMPUTER-CONTROLLED HIGH-ALTITUDE DATA AQUISITION SYSTEM Abstract Only
In its China Rept.: Sci. and Technol. (JPRS-CST-85-015) 16 May 1985 p 36 Transl. into ENGLISH from Jisuanji Shijie (Beijing), no. 7, 8 Apr. 1984 p 8 (For primary document see N86-11994 02-70)
Avail: NTIS HC A07/MF A01

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N86-11550# Academy of Sciences, Potsdam (East Germany). Zentralinst. fuer Physik der Erde.
FIGURE OF THE EARTH, MOON, AND PLANETS Progress Report, 1981-1984
M. Bursa *In its* Proc. of the 5th Intern. Symp. Geodesy and Phys. of the Earth 1985 p 10-24 refs (For primary document see N86-11549 02-42)
Avail: NTIS HC A09/MF A01

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights. For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N86-12191*# Lunar and Planetary Inst., Houston, Tex. Lunar and Planetary Sample Team.
HORIZONS AND OPPORTUNITIES IN LUNAR SAMPLE SCIENCE
1985 37 p
(Contract NASw-3389)
(NASA-CR-176290; NAS 1.26:176290; LPI-TR-85-04) Avail: NTIS HC A03/MF A01 CSCL 03B

The Moon is the cornerstone of planetary science. Lunar sample studies were fundamental in developing an understanding of the early evolution and continued development of planetary bodies, and have led to major revisions in understanding of processes for the accumulation of planetesimals and the formation of planets. Studies of lunar samples have increased an understanding of impact cratering, meteoroid and micrometeoroid fluxes, the interaction of planetary surfaces with radiations and particles, and even the history of the Sun. The lunar sample research program was especially productive, but by no means have all the important answers been determined; continued study of lunar samples will further illuminate the shadows of our knowledge about the solar system. Further, the treasures returned through the Apollo program provide information that is required for a return to the Moon, beginning with new exploration (Lunar Geoscience Observer (LGO)), followed by intensive study (new sample return missions), and eventually culminating in a lunar base and lunar resource utilization. G.L.C.

N86-12192*# Lunar and Planetary Inst., Houston, Tex.
WORKSHOP ON DUST ON MARS
Steven Lee, ed. et al 1985 30 p refs Workshop held at Tempe, Ariz., 4-5 Feb. 1985
(Contract NASw-3389)
(NASA-CR-176293; NAS 1.26:176293; LPI-TR-85-02) Avail: NTIS HC A03/MF A01 CSCL 03B

A workshop was organized to stimulate and coordinate research on the properties of Martian dust, its distribution on the planet, and the processes affecting its yearly deposition, erosion, and transport. A great deal of research was carried out to understand local, regional, and global aspects of the Martian dust transport cycle, with the goal being definition of the currently active processes and their relation to those operating over the long term. To date, however, most individual research projects have centered around interpretation of single data sets (visual images, IRTM, radar, etc.), and these many efforts were not coordinated. Many of the details of short and long term dust-related processes, as inferred from the various single data sets, are still not agreed upon. It was the intent of this workshop to encourage the informal exchange of ideas among several researchers currently investigating various aspects of the problem and to investigate cooperative efforts to synthesize the individual approaches into a unified understanding of the present seasonal and yearly Martian sediment transport cycles. G.L.C.

N86-12193# Los Alamos Scientific Lab., N. Mex.
MARS BASE BUILDUP SCENARIOS
J. D. Blacic 1985 13 p Presented at the Manned Mars Mission Workshop, Huntsville, Ala., 10 Jun. 1985
(Contract W-7405-eng-36)
(DE85-014132; LA-UR-85-1989; CONF-8506149-2) Avail: NTIS HC A02/MF A01

Two surface base build up scenarios are presented in order to help visualize the mission and to serve as a basis for trade studies. In the first scenario, direct manned landings on the Martian surface occur early in the missions and scientific investigation is the main driver and rationale. In the second scenario, early development of an infrastructure to exploit the volatile resources of the Martian moons for economic purposes is emphasized. Scientific exploration of the surface is delayed at first, but once begun develops rapidly aided by the presence of a permanently manned orbital station. DOE

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N86-12194*# National Aeronautics and Space Administration, Washington, D. C.
INTERNATIONAL SOLAR-TERRESTRIAL PHYSICS PROGRAM: A PLAN FOR THE CORE SPACEFLIGHT MISSIONS
1985 24 p refs Prepared in cooperation with European Space Agency, Paris, France, and Tokyo Univ., Japan Original contains color illustrations
(NASA-TM-87511; NAS 1.15:87511) Avail: NTIS HC A02/MF A01 CSCL 03B

This brochure has been prepared by NASA on behalf of the European Space Agency (ESA), the Institute of Space and Astronautical Science (Japan) (ISAS), and the U.S. National Aeronautics and Space Administration (NASA) to describe the scope of the science problems to be investigated and the mission plan for the core International Solar-Terrestrial Physics (ISTP) Program. This information is intended to stimulate discussions and plans for the comprehensive worldwide ISTP Program. The plan

for the study of the solar - terrestrial system is included. The Sun, geospace, and Sun-Earth interaction is discussed as is solar dynamics and the origins of solar winds. Author

N86-12195*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE 1984 SOLAR OSCILLATION PROGRAM OF THE MOUNT WILSON 60-FOOT TOWER
Edward J. Rhodes, Jr., Alessandro Cacciani (Rome Univ.), Steven Tomczyk (California Univ., Los Angeles), and Roger K. Ulrich [1985] 25 p refs Sponsored in part by CNR and Minestero della Pubblica Istruzione
(Grants NAGw-13; NAGw-472)
(NASA-CR-176248; NAS 1.26:176248) Avail: NTIS HC A02/MF A01 CSCL 03B

The instrumentation, data, and preliminary results from the summer, 1984, solar oscillation observing program which was carried out using the 60-foot tower telescope of the Mt. Wilson Observatory are described. This program was carried out with a dedicated solar oscillation observing system and obtained full-disk Dopplergrams every 40 seconds for up to 11 hours per day. Between June and September, 1984, observations were obtained with a Na magneto-optical filter on 90 different days. The data analysis has progressed to the point that spherical harmonic filter functions were employed to generate a few one-dimensional power spectra from a single day's observations. Author

93 SPACE RADIATION

Includes cosmic radiation; and inner and outer Earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N86-12196*# Pennsylvania State Univ., University Park.
X-RAY INVERSE COMPTON EMISSION FROM THE RADIO HALO OF M87 Final Report, 1 Nov. 1983 - 30 Oct. 1984
Eric D. Feigelson [Oct. 1984] 4 p refs
(Grant NAG8-457)
(NASA-CR-176305; NAS 1.26:176305) Avail: NTIS HC A02/MF A01 CSCL 03B

A significant fraction of known galaxies contain an active galactic nucleus (AGN) at their cores, the site of violent activity and non-stellar radiation seen across the entire electromagnetic spectrum. This activity is thought to be due to the accretion of gas onto a massive black hole. A fraction of AGNs also eject collimated beams of energetic material, usually seen by virtue of its synchrotron emission in the radio band. Efforts to study these jets from AGNs in the X-ray band with the Einstein Observatory has led to several detections, most notably the jets in the nearby radio galaxies Centaurus A and Virgo A = M87. In their study of M87, Schreier, Gorenstein and Feigelson (1982) noted that, in addition to the synchrotron jet 10'-20' from the nucleus, X-rays appear to be generated in the diffuse radio halo 2'-5' from the nucleus. This finding may be particularly important as it may constitute the first known case of X-ray inverse Compton emission from AGN ejecta, allowing for the first time direct determination of the magnetic field strengths. G.L.C.

N86-12197*# Pennsylvania State Univ., University Park. Dept. of Astronomy.
X-RAY INVERSE COMPTON EMISSION FROM THE RADIO HALO OF M87 M.S. Thesis
Perry Alan David Wood May 1985 51 p refs
(Grant NAG8-457)
(NASA-CR-176304; NAS 1.26:176304) Avail: NTIS HC A04/MF A01 CSCL 03B

M87 has been observed in the 0.2-4 KeV X-ray band using the High Resolution Imager on the Einstein Observatory, and at 1.452 GHz using the Very Large Array. The radio map showed that the halo contained prominent asymmetries to the east and southwest. The X-ray map indicated similar asymmetries, but they were imbedded in the diffuse hot gas that surrounds the core out to a radius of several arcminutes. The hot X-ray emitting gas was assumed to be spherically symmetric and could, therefore, be subtracted from the image. The resultant image was asymmetric with major lobes to the east and southwest that coincide approximately with the asymmetries in the radio halo. The data indicates that inverse Compton emission is a plausible model for the X-rays coming from the asymmetric component. Author

N86-12198# Los Alamos Scientific Lab., N. Mex.
COSMOGENIC-NUCLIDE PRODUCTION BY PRIMARY COSMIC-RAY PROTONS
R. C. Reedy 1985 5 p refs Presented at 19th Intern. Cosmic Ray Conf., La Jolla, Calif., 11 Aug. 1985
(Contract W-7405-eng-36)
(DE85-012760; LA-UR-85-1921; CONF-850883-1) Avail: NTIS HC A02/MF A01

The production rates of cosmogenic nuclides were calculated for the primary protons in the galactic and solar cosmic rays. AT 1 AU, the long-term average fluxes of solar protons usually produce many more atoms of a cosmogenic nuclide than the primary protons in the GCR, the exceptions being nuclides made only by high-energy reactions (like Fe-10). Because the particle fluxes inside meteorites and other large objects in space include many secondary neutrons, the production rates and ratios inside large objects are often very different from those by just the primary GCR protons. Thus it is possible to determine, by examining its cosmogenic nuclides, if a small object, such as found among deep-sea spherules, was small in space or broken from a meteorite. Because heliospherical modulation and other interactions change the GCR particle spectrum, the production of cosmogenic nuclides by the GCR particles outside the heliosphere will be different from that by modulated GCR primaries. Production rates and ratios for cosmogenic nuclides would be able to identify small particles, possibly interstellar in origin, that were exposed to an unmodulated spectrum of GCR particles and to characterized the spectrum of particles to which they were exposed. DOE

99 GENERAL

No abstracts in this category.

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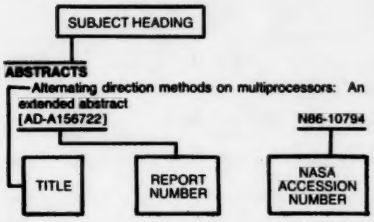

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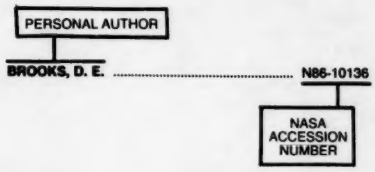

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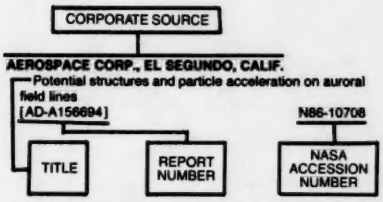

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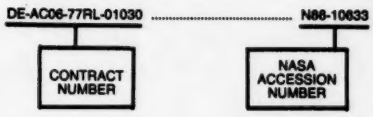

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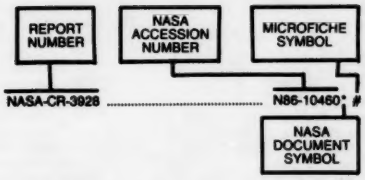

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LC-85-13854 ..... N86-12168* #
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NBS-SP-698 ..... N86-11367* #

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